DESCRIPTION OF PROPOSED MODIFICATION

Skybox Imaging, Inc. (Skybox) currently operates a pair of commercial remote sensing satellites that are licensed under the laws of the United States (FCC Call Sign S2862) and the regulations of the International Telecommunication Union (ITU) (Satellite Name USASAT-30E). Transmissions to and from the satellites in Skybox's network use standard communications protocols typical of other satellites operating in the Earth Exploration Satellite Service (EESS) frequency bands. The USASAT-30E, or SkySat, satellites have been in operation for a combined duration of nearly two years with no reported instances of interference with other satellite networks.

With this application, Skybox respectfully requests modification of its existing Federal Communications Commission (FCC) authority in order to launch and operate additional high-resolution imagery satellites that complement the original SkySat system.[1] The addition of these follow-on satellites to the SkySat fleet will further enhance Skybox's EESS offering and provide a stronger American presence in the industry. As detailed below, the proposed additional low-Earth system launches will consist of up to 13 non-geostationary orbit (NGSO) satellites using the 8025-8400 MHz band allocated to EESS. Commands to the spacecraft from the system's ground segment will operate in the 2025-2110 MHz band.

SkySat-3 through SkySat-15 are under construction and Skybox anticipates launching SkySat-3 as early as December 2015.[2] Skybox, moreover, has obtained from the National Oceanic and Atmospheric Administration (NOAA) a license to operate a 24-satellite private remote sensing space system that is the subject of this application.[3] Skybox will pursue future license applications for the additional satellites beyond SkySat-15. Timely grant of this application for license modification and deployment of SkySat-3 through SkySat-15 will enable Skybox to continue and improve its cost-effective, high-resolution imaging services for customers in the U.S. and around the world.

In support of the instant request for modification of its authorization, Skybox offers the following information concerning its proposed follow-on satellites.

I. Information Required Under Section 25.114(d) of the Commission's Rules

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[1] *See* IBFS File Nos. SAT-LOA-20120322-00058 and SAT-T/C-20140613-00068.

[2] Skybox's notification of commencement of space station construction is included as Attachment A to this Exhibit 43.

[3] *See* Skybox Imaging, Inc., License from NOAA to Operate a Private Remote Sensing Space System (effective November 20, 2013). On July 18, 2014, NOAA approved a change in administrative control to allow Google Inc.'s acquisition of Skybox. On July 30, 2014, the Commission likewise approved the change in control of Call Signs S2862, E120025, and E130037. On August 4, 2014, Google informed the Commission that the transaction had been consummated.

A. General Description of Overall Facilities, Operations, and Services

The proposed complementary Skybox EESS system will consist of a space segment comprised of SkySat-3 through SkySat-15 and a ground segment comprised of a primary earth station located in Fairbanks, Alaska (Call Sign E120025), a back-up earth station located in Half Moon Bay, California (Call Sign E130037), and other earth stations located outside the United States. Each satellite is designed to receive commands from a ground station and to downlink the data collected by three imaging sensors and stored onboard the satellite, as well as telemetry data.

The proposed Skybox satellites will be three-axis stabilized using an on-board closed-loop control system. The satellites are based on advanced technology that allows for small, lightweight and low-cost spacecraft. SkySat-3 through SkySat-15 will be nearly identical to Skybox's current SkySat-1 and SkySat-2 satellites operating in independent circular inclined orbits.[4]

The proposed satellites are planned to launch as primary and secondary payloads on their respective launch vehicles. SkySat-3 is scheduled to be launched as a secondary payload on an Indian Space Research Organisation PSLV launch vehicle from Sriharikota, India as early as December 2015. SkySat-4 through SkySat-7 are scheduled to be launched as secondary payloads on an Arianespace Vega launch vehicle from Kourou, French Guiana as early as July 2016. SkySat-8 through SkySat-13 are scheduled to be launched as primary payloads on an Orbital-ATK Minotaur-C launch vehicle from Vandenberg AFB as early as September 2016. SkySat-14 and SkySat-15 will launch in 2017 on a yet to be determined launch vehicle[5]. The satellites are designed to operate in high-inclination circular orbits with the altitude in the range of 400 to 630 km and inclinations between 97.0 and 97.9 degrees. The satellites are expected to operate in a sun-synchronous orbit with a nominal altitude of 500 km. The orbital period for the spacecraft will be in the range from 92.6 to 97.4 minutes. With a minimum orbit altitude of 400 km, the expected orbital lifetime of the satellites would be 0.85 years after the end of mission operations. The expected orbital lifetime increases to 25 years if the orbit altitude is at the maximum of 630 km after the end of mission operations.

The data collected by the sensors onboard the satellites will be processed, stored and downlinked in the 8025-8400 MHz band to the appropriate earth station while the satellites are visible from that particular earth station site at a minimum 5 degree elevation angle. The storage capacity onboard each satellite is 768 GB. For telemetry, tracking and command (TT&C) functions, the Skybox satellites will receive command communications from gateway earth stations using the 2025-2110 MHz band, which is

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[4] The proposed Skybox satellites are expected to have minor, non-functional differences to accommodate different launch vehicles.

[5] The future satellite launches for remaining satellites will conform to orbital debris and other applicable obligations.

authorized in the EESS subject to such conditions as may be applied on a case-by-case basis.[6] The ground segment will consist of several earth stations around the world equipped with 1.5 m–2.4 m antennas. Command signals will be issued from the mission operations center in Mountain View, California, and uplinked to the satellites via the primary TT&C earth stations located in Fairbanks, Alaska[7] and Tromso, Norway.[8] Telemetry data from the satellites will be received at the earth stations and relayed to the Mountain View operations center.

B. Description of Types of Services and Areas to be Served

The proposed Skybox EESS satellites will complement the operational SkySat-1 and SkySat-2, and continue to provide satellite imagery and derived information products on a non-common carrier basis to commercial customers and governments worldwide. Industries to benefit from the information that Skybox will make available under the requested authorization include the oil and gas, agriculture, real estate and construction, natural resources, news media, and online mapping industries.

C. Technical Description

As noted above, the communication payload onboard the satellites is designed to receive commands from the associated earth stations (including telecommand signals from Skybox) and to downlink the data collected by three imaging sensors and stored onboard the satellites as well as the telemetry data required for operating the satellites. A block diagram of the communication payload is shown in Figure 1 below.

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[6] *See* 47 C.F.R. § 2.106, footnote US347.

[7] The 2.4 meter earth station in Fairbanks, Alaska providing uplink command signals will be operated under FCC Call Sign E120025. To the extent that additional antennas are required to expand the capabilities of the Fairbanks earth station, Skybox will seek a separate earth station license modification from the Commission.

[8] Other earth stations outside of the U.S. may have the capability to uplink command signals to the SkySat satellites. In every case, however, core satellite command signals will originate at Skybox's Mountain View, California, mission operations center and will be relayed to the satellites without change from an earth station in the network.

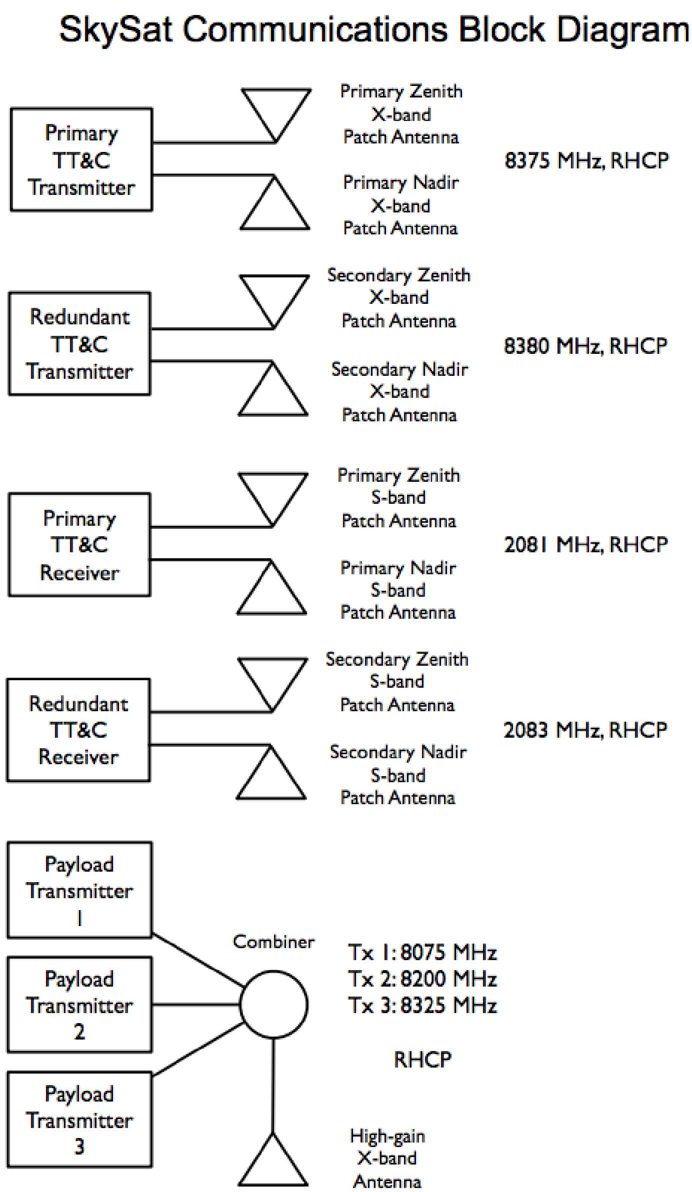

Figure 1. Communications Payload Block Diagram

The three transmitters operating in the 8025-8400 MHz band via a high gain antenna are used for downlinking the data collected and stored at each satellite. Data collected by each of the sensors at any time during the orbit is later downlinked by its respective data transmitter when the satellite is in view of one of the earth stations in the Skybox network. The data transmitters are nominally configured to downlink simultaneously, though individual operation is possible if required. This configuration also provides data downlink redundancy: the satellite will still operate (at a reduced capacity) even if two of the data transmitters fail. The redundant TT&C transmitters and receivers operating via low gain antennas are used for telemetry transmission and command reception.

The technical characteristics of the proposed complementary Skybox EESS satellites are detailed in the Schedule S portion of the FCC Form 312 of this Application. The proposed satellites' link budgets are included as Attachment B hereto, and the proposed space station antenna patterns are included as Attachment C hereto. Attachment D shows the predicted gain contours required by Section 25.114(d)(3) of the Commission's rules at the two U.S. earth station sites from a 90 degree elevation angle.[9] Skybox has relied upon its expertise in satellite design and selection of components, as well as its experience operating SkySat-1 and SkySat-2, in developing space station operational lifetime and reliability estimates. Pursuant to changes in 47 C.F.R §25.114 adopted by the commission on August 9, 2013 entries in tables S.15 and S.16 were omitted.

D. Power Flux Density Calculation

1. Power Flux Density at the Surface of the Earth in the band 8025- 8400 MHz

Commission Rule 25.208 does not contain limits on power flux density (PFD) at the Earth's surface produced by emissions from NGSO EESS space stations operating in the 8025-8400 MHz band.[10] However, Table 21-4 of the ITU Radio Regulations states that the PFD at the Earth's surface produced by emissions from an EESS space station in the 8025-8400 MHz band, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the following values:

- –150 dB(W/m2) in any 4 kHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;
- –150 + 0.5(d -5) dB(W/m2) in any 4 kHz band for angles of arrival d (in degrees) between 5 and 25 degrees above the horizontal plane; and
- –140 dB(W/m2) in any 4 kHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

These limits relate to the PFD that would be obtained under assumed free-space propagation conditions. As shown in Figures 2 through 7 below, the PFDs at the Earth's surface produced by the SkySat-3 through SkySat-15 data and telemetry transmissions

[9] The gain contours are plotted at the intended 500 km altitude for SkySat-3 through SkySat-15. In several of the plots, contours beyond -8 dB or -10 dB from peak are not shown because they do not intersect with the Earth.
[10] 47 C.F.R. § 25.208.

satisfy the PFD limits in the ITU Radio Regulations for all angles of arrival.[11] In addition, the transmit power for both the TT&C and payload data transmitters is adjustable on orbit. This capability supports Skybox's ability to manage the satellites' PFD levels during all phases of the mission (i.e. for all operational altitudes).

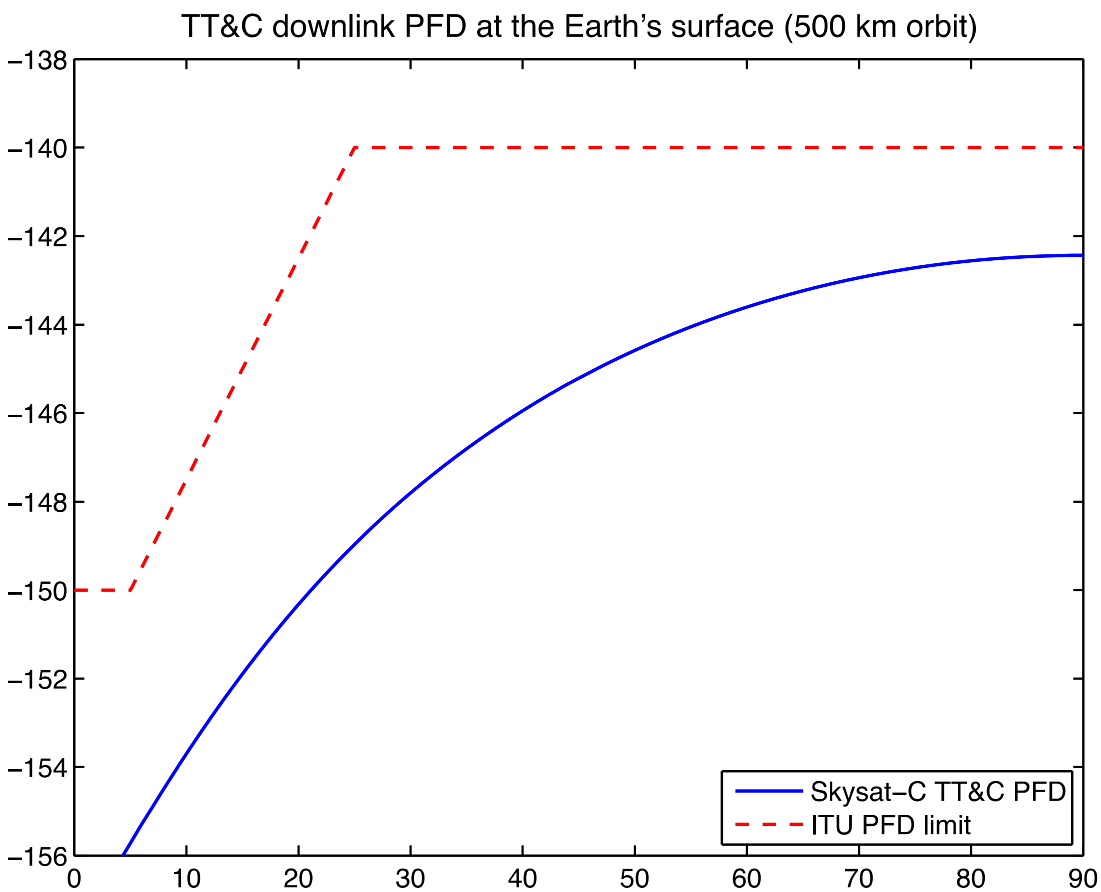

Figure 2. PFD at the Surface of the Earth produced by SkySat Telemetry Downlinks (shown for baseline 500 km orbit altitude)

[11] Figures 2 and 3 depict the SkySat-3 through SkySat-15 PFDs at the intended altitude of 500 km.

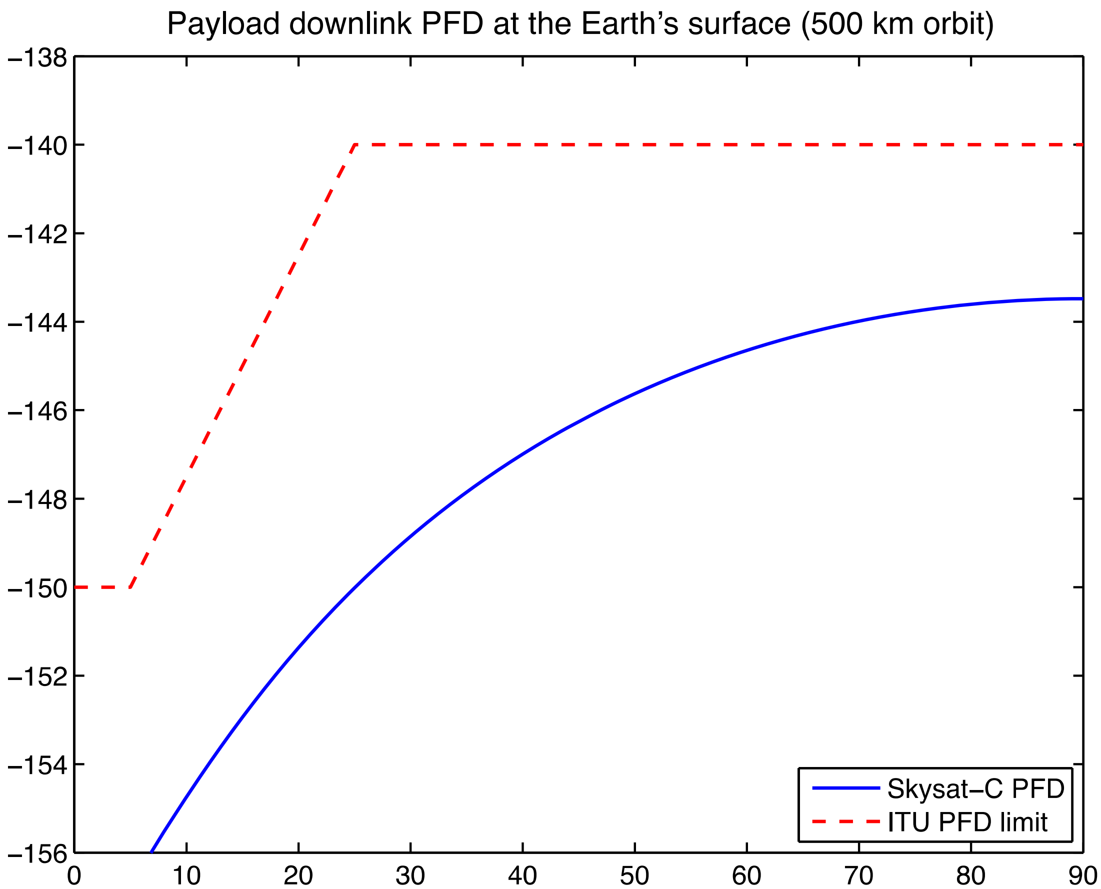

Figure 3. PFD at the Surface of the Earth produced by SkySat Data Downlinks (shown for baseline 500 km orbit altitude)

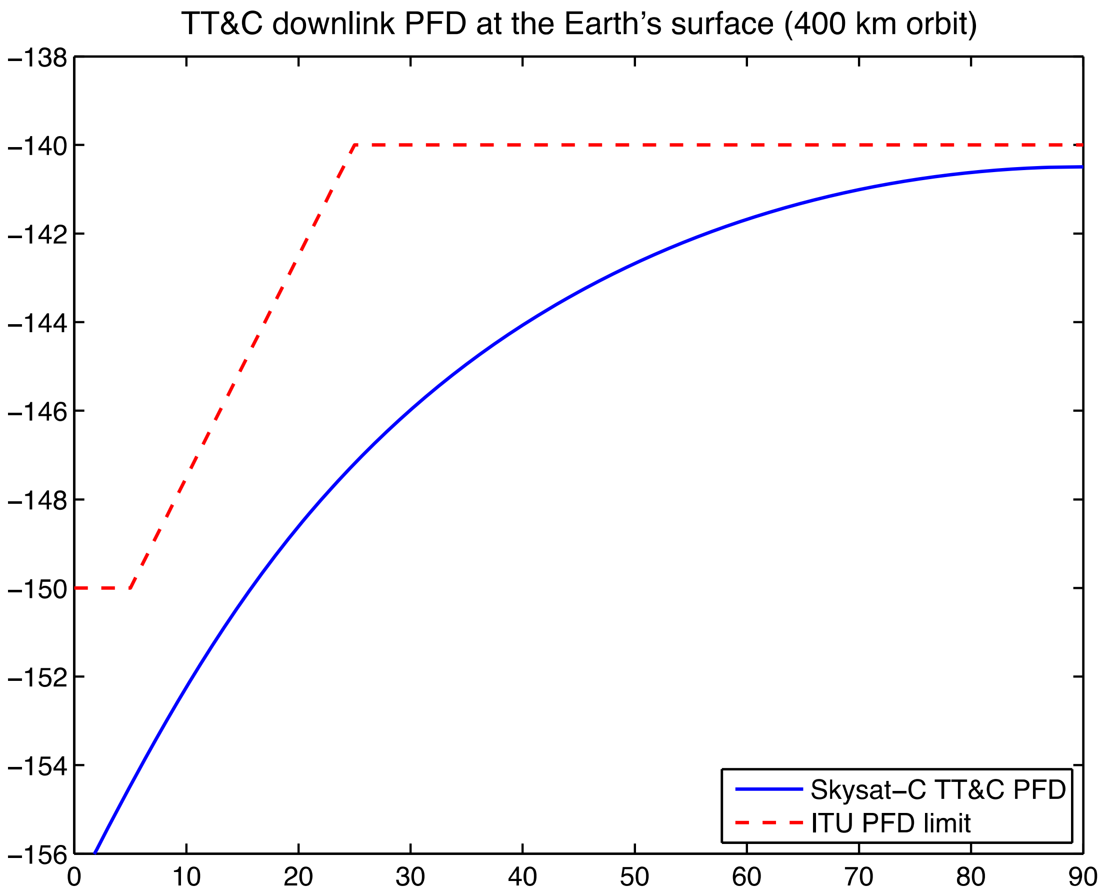

Figure 4. PFD at the Surface of the Earth produced by SkySat Telemetry Downlinks (shown for the minimum 400 km orbit altitude)

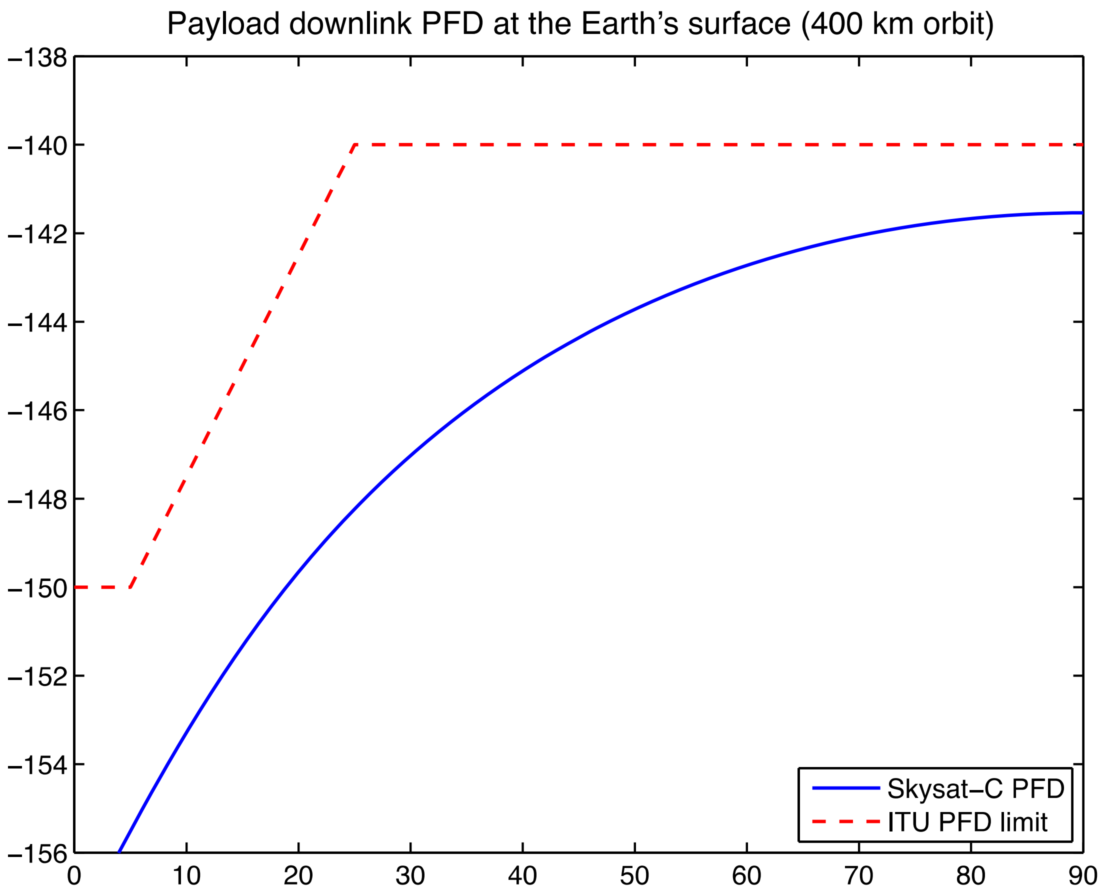

Figure 5. PFD at the Surface of the Earth produced by SkySat Data Downlinks (shown for the minimum 400 km orbit altitude)

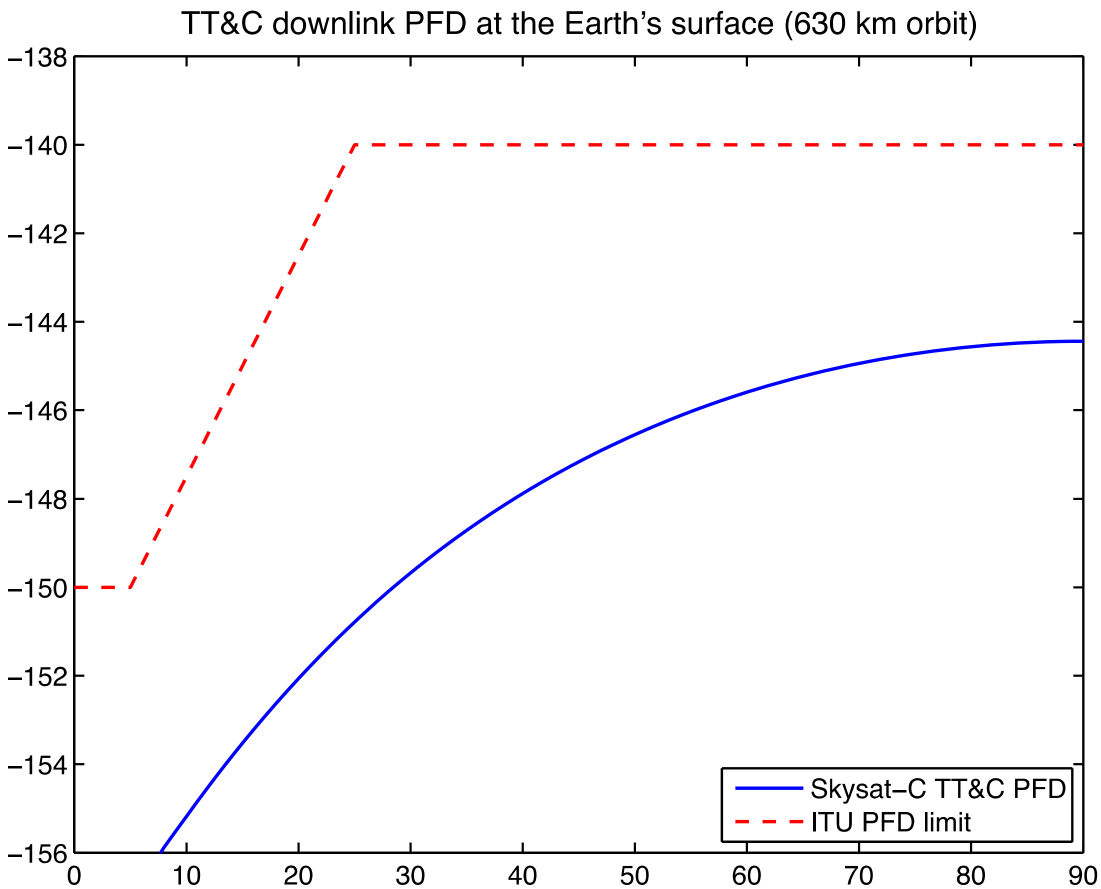

Figure 6. PFD at the Surface of the Earth produced by SkySat Telemetry Downlinks (shown for the maximum 630 km orbit altitude)

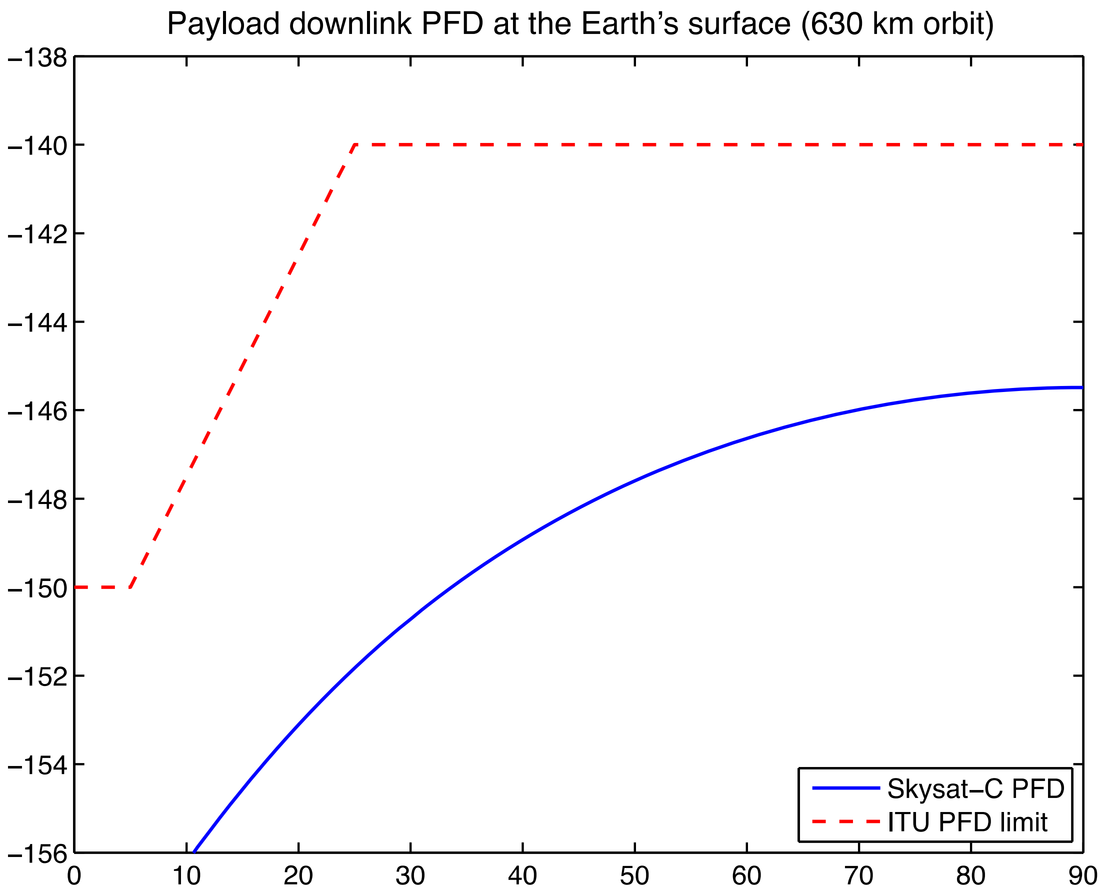

Figure 7. PFD at the Surface of the Earth produced by SkySat Data Downlinks (shown for the maximum 630 km orbit altitude)

2. Power Flux Density at the Surface of the Earth in the band 8400- 8450 MHz

ITU-R Recommendation SA-1157 specifies a maximum allowable interference power spectral flux-density level at the Earth's surface of -255.1 dB(W/(m^{2}Hz)) to protect ground receivers in the deep-space research band 8400-8450 MHz. Skybox uses a combination of digital filtering at the baseband signal (root-raised cosine filters with a roll-off factor of 0.35), a 7-th order analog baseband reconstruction filter, and bandpass RF filtering at the output of the transmitters provided by a triplexer to achieve the ITU recommended protection level for the 8400-8450 MHz band.

3. Power Flux Density at the Geostationary Satellite Orbit

ITU Radio Regulation No. 22.5 specifies that in the frequency band 8025-8400 MHz, which the EESS using non-geostationary satellites shares with the fixed-satellite service (Earth-to-space) or the meteorological-satellite service (Earth-to-space), the maximum PFD produced at the geostationary satellite orbit (GSO) by any EESS space station shall not exceed –174 dB(W/m2) in any 4 kHz band. The calculation below shows that the PFD produced by the transmissions from the proposed complementary Skybox EESS satellites does not exceed the limit in No. 22.5, even in the worst possible hypothetical case.

The PFD at the GSO produced by the Skybox transmission is:

PFD [dB(W/m2 /4 kHz)] = EIRP (dBW) - 71 - 20log10(D) - 10log10(BW) - 24

Where:

- EIRP is the Maximum EIRP of the transmission, in dBW;
- D is distance between the Skybox satellite and GSO, in km; and
- BW is the symbol bandwidth of the transmission, in MHz.

The minimum possible distance between a Skybox satellite and the GSO is 35786 - 630 = 35156 km for the highest possible Skybox satellite orbit of 630 km. Under a hypothetical assumption that the Skybox satellite antenna is radiating at its peak EIRP directly toward the GSO, the data downlink transmission with the peak EIRP = 24.0 dBW and BW = 76 MHz produces a PFD at the GSO of -181.0 dB(W/m2) in any 4 kHz band.[12] Under the same hypothetical assumptions, the telemetry transmission from the Skybox satellite produces a maximum PFD at the GSO of - 176.6 dB(W/m2) in any 4 kHz band.

E. Interference Analysis

1. Interference between EESS systems operating in the band 8025-8400 MHz

Interference between the Skybox satellites and those of other systems is very unlikely because EESS systems operating in the 8025-8400 MHz band normally transmit only in short periods of time while visible from the dedicated receiving earth stations. For interference to happen, satellites belonging to different systems would have to travel through the antenna beam of the receiving earth station and transmit at the same time. In such a very unlikely event, the interference can still be avoided by coordinating the satellite transmissions so that they do not occur simultaneously.

[12] The symbol bandwidth of the transmission is 76 MHz, while the assigned bandwidth of the same transmission, shown in Schedule S, is 100 MHz. This PFD calculation is the same for the 60 MHz bandwidth transmissions since the transmission power is adjusted accordingly.

2. Interference with the Fixed Service and the FSS in the band 8025-8400 MHz

Sections I.D.1 and I.D.3, above, demonstrate that the SkySat satellite transmissions will meet the limits specified by the ITU for protection of the Fixed Service in the 8025-8400 MHz band, as well as the geostationary FSS satellites using this band for their uplinks.

3. Protection of the deep-space research in the band 8400-8450 MHz

Section I.D.2, above, demonstrates that the protection criterion recommended by the ITU for deep-space research in the 8400-8450 MHz band is met.

F. Public Interest Considerations

The grant of this application will serve the public interest by permitting Skybox to launch and operate complementary high-resolution imagery satellites to the SkySat-1 and SkySat-2 satellites, thereby enhancing competition and expanding U.S. capabilities in the market for commercial remote sensing data. Skybox's innovative approach—using small, lightweight and low-cost satellites—allows the company to meet the growing demand for high resolution imagery in a cost-effective, timely manner, and deployment of the proposed satellites will further enhance Skybox's EESS capabilities.

G. Orbital Debris Mitigation

The additional SkySat satellites proposed in the instant application for license modification will not undergo any planned release of debris during their normal operations. In addition, all separation and deployment mechanisms, and any other potential source of debris will be retained by the spacecraft or launch vehicle. Skybox also has assessed the probability of the space stations becoming sources of debris by collision with small debris or meteoroids of less than one centimeter in diameter that could cause loss of control and prevent post-mission disposal. Skybox has taken steps to limit the effects of such collisions through shielding, the placement of components, and the use of redundant systems.

Skybox has assessed and limited the probability of accidental explosions during and after completion of mission operations through a failure mode verification analysis. As part of the satellite manufacturing process, Skybox has taken steps to ensure that debris generation will not result from the conversion of energy sources on board the satellites into energy that fragments the satellites. All sources of stored energy onboard the spacecraft will have been depleted or safely contained when no longer required for mission operations or post-mission disposal.

Skybox has assessed and limited the probability of the space stations becoming a source of debris by collisions with large debris or other operational spacecraft. Skybox does not intend to place SkySat-3 through SkySat-15 in an orbit that is identical to or very similar to an orbit used by other space stations, and, in any event, will work closely with the launch providers to ensure that the satellites are deployed in such a way as to minimize the potential for collision with any other spacecraft. This specifically includes minimizing the potential for collision with manned spacecraft. To the best of Skybox's understanding, the International Space Station and China's Tiangong-1 Space Station module are the only presently or imminently inhabited orbiting objects.[13] The operational altitude of the International Space Station is approximately 400 km,[14] and the altitude of the Tiangong-1 space module is now approximately 382 km.[15] While both facilities are significantly below the baseline operational orbit altitude of 500 km for SkySat-3 through SkySat-15, Skybox will be proactive to ensure that risks to inhabitable orbiting objects from any of its SkySat satellites are mitigated. This will include coordinating with NASA to assure protection of the International Space Station on an ongoing basis, and with the China National Space Agency with respect to Tiangong-1 and successor vehicles. Skybox will provide both agencies with all information they need to assess risks and ensure safe flight profiles, and with contact information for Skybox personnel on a 24 hours per day/7 day per week basis. Through these measures, Skybox will be able to avoid collisions even if there is at some future point less separation in orbits than is anticipated at a minimum today.[16]

Section 25.114(d)(14)(iii) of the Commission's rules calls upon applicants to specify the accuracy, if any, with which the orbital parameters of their non-geostationary satellite orbit space stations will be maintained.[17] SkySat-3 through SkySat-15 satellites include a propulsion system and the orbits are anticipated to remain in their planned orbit with an accuracy within the ranges given in Table 1 below as a result of regular corrective propulsive maneuvers by Skybox. To the extent that Section 25.114(d)(14)(iii) also calls for indication of the anticipated evolution over time of the satellites' orbits, Skybox notes that the SkySat satellites at end of life will be in orbits that gradually decay over time until the satellites reenter the atmosphere. At the minimum initial altitude of 400 km, the satellite will reenter the atmosphere in approximately 0.85 years; at the maximum initial altitude of 630 km, reentry will occur

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[13] The Tiangong-1 spacecraft is an experimental space module that is destined to be part of a larger space complex over the next decade. It will be intermittently inhabited, with planned manned space missions to occur beginning this year.

[14] http://www.nasa.gov/mission_pages/station/expeditions/expedition26/iss_altitude.html (last visited Jan. 16. 2015).

[15] http://www.china.org.cn/china/2011-11/19/content_23957633.htm (last visited Jan. 16. 2015).

[16] Skybox will take identical proactive measures with respect to any other inhabitable orbiting objects that may be introduced during the time when SkySat spacecraft are in orbit. In particular, Skybox notes that testing of inhabitable space objects by Bigelow Aerospace LLC may occur during the license term.

[17] 47 C.F.R. § 25.114(d)(14)(iii).

within 25 years.[18]

Table 1. Anticipated Orbit Maintenance Accuracy for SkySats

	SkySat Orbital Parameters Accuracy
Inclination Angle (deg.)	+/- 0.1
Apogee (km)	+/- 20
Perigee (km)	+/- 20
Semi-major Axis (km)[19]	+/- 1.0
Right Ascension of the Ascending Node (deg)[20]	+/- 0.25

Skybox's disclosure of the above parameters, as well as the number of space stations, the number and inclination of orbital planes, and the orbital period to be used, can assist third parties in identifying potential problems that may be the result of proposed operations. This information also lends itself to coordination between Skybox and other operators located in similar orbits.

As noted above, proposed Skybox satellites are commercial remote sensing satellites subject to regulation by NOAA under Title 51 of the U.S. Code, as well as regulation by the Commission. Pursuant to licensing requirements codified under Title 51,[21] Skybox has requested and received favorable action from NOAA on its plan for the post-mission disposal of its spacecraft.[22] The Commission has previously determined that "[t]o the extent that a remote sensing satellite applicant has submitted its post-mission disposal plans to NOAA for review and approval, [it] will not require submission

[18] For SkySat-3 through SkySat-15, with a proposed orbit altitude of 500 km, decay of the orbit to the reentry point will take approximately 13 years.
[19] Semi-major axis will be maintained with a tight tolerance. Eccentricity will be kept small, but is expected to vary, causing fluctuations in apogee and perigee altitudes.
[20] RAAN tolerance given is relative to a rotating sun-sync orbital plane, which regresses to match the Sun's apparent motion to the Earth.
[21] *See* 51 U.S.C. § 60122(b).
[22] *See* Skybox Imaging, Inc. License from National Oceanic and Atmospheric Administration to Operate a Private Remote Sensing Space System (issued June 30, 2011).

of such information" as part of its examination of the debris mitigation disclosures of remote sensing satellites.[23] Accordingly, no submission regarding Skybox's post-mission disposal plans is required or included with this application.

H. Extent of Communications with SkySat-3 through SkySat-15 During Descent to the Atmosphere

Skybox intends to utilize the proposed complementary Skybox satellites for communications services (including TT&C functions) from the point at which each satellite is placed into its operational orbit until the satellite reaches an altitude during its descent where final re-entry into the atmosphere is imminent. Reentry will be imminent at an altitude of approximately 200 km. At all altitudes down to the reentry altitude, Skybox will maintain the satellites' PFD at levels within the applicable ITU limits by reducing satellite transmitter power on a graduated basis as the satellite nears the Earth.[24]

II. Additional/General Considerations

A. Waiver Request of Modified Processing Round Rules

Skybox requests that this application be processed pursuant to the first-come, first-served procedure adopted for "GSO-like satellite systems" under Section 25.158 of the Commission's rules.[25] To the extent necessary to allow for such processing, Skybox also requests waiver of Sections 25.156 and 25.157 of the Commission's rules, which stipulate the processing of "NGSO-like satellite systems" under a modified processing round framework.[26]

The Commission may waive any of its rules if there is "good cause" to do so.[27] In general, waiver is appropriate if: (1) special circumstances warrant a deviation from the general rule; and (2) such deviation would better serve the public interest than would strict adherence to the general rule.[28] Generally, the Commission will grant a waiver of its rules in a particular case if the relief requested would not undermine the policy

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[23] *See* Mitigation of Orbital Debris, 19 FCC Rcd 11567, 11610 (2004). The Commission's decision addressed 15 U.S.C. § 5622(b)(4), which contained a licensing requirement identical to that in 51 U.S.C. § 60122(b)(4) to notify NOAA of the post-mission disposal of spacecraft. Section 60122 of Title 51 replaced Section 5622 of Title 15 effective December 18, 2010. See Pub.L. 111-314, 124 Stat. 3328 (2010).

[24] Skybox satellite transmitters have 256 steps of output power adjustments over the range from 0.1 to 1.5 watt output power.

[25] 47 C.F.R. § 25.158.

[26] 47 C.F.R. §§ 25.156 and 25.157.

[27] 47 C.F.R. § 1.3; *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969) ("*WAIT Radio*"); *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990) ("*Northeast Cellular*").

[28] *Northeast Cellular*, 897 F.2d at 1166.

objective of the rule in question, and would otherwise serve the public interest.[29]

The Commission has previously waived the modified processing round requirement and allowed EESS NGSO satellite systems to be processed on a first-come, first-served basis. In Space Imaging, LLC, the Commission concluded that authorizing Space Imaging to operate in its requested EESS frequency bands would not preclude other NGSO operators from operating in those bands because NGSO EESS operators are generally capable of sharing spectrum in the same frequency.[30] The Commission also cited the fact that "very few" U.S. licensed EESS NGSO systems operating in the band further reduced the possibility of interference with other operators in the 8025-8400 MHz band.[31] In light of these circumstances, the Commission concluded that Space Imaging's applications warranted GSO-like processing, and waived Sections 25.156 and 25.157 of its rules.[32]

Similar to the EESS NGSO system in Space Imaging, Skybox's system is fully capable of sharing with current and future NGSO systems operating in the same frequency bands. Spectrum sharing will be possible because the Skybox satellites and satellites in other systems transmit only in short periods of time while visible from the dedicated receiving earth station. For harmful interference to happen, satellites belonging to different systems would have to travel through the antenna beam of the receiving earth station and transmit at the exact same time. In such an unlikely event, the resulting interference can still be avoided by coordinating the satellite transmission so that they do not occur simultaneously. For these reasons, the waiver request here is fully warranted because waiving Sections 25.156 and 25.157 will not undermine the policy objectives of those rules.

B. Waiver Request of Default Service Rules

Skybox requests a waiver of the default service rules under Section 25.217(b) of the Commission's rules.[33] Because NGSO EESS system licensees must comply with the technical requirements in Part 2 of the Commission's rules, which should prevent harmful interference to other operators in the requested band, the Commission should grant Skybox a waiver of the default service rules.

The Commission previously granted a waiver of the default service rules contained in Section 25.217(b) for the existing SkySat-1 and SkySat-2,[34] based on the requirement that EESS operators in the 8025-8400 MHz band are required to comply

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[29] *WAIT Radio*, 418 F.2d at 1157.
[30] *See Space Imaging, LLC*, 20 FCC Rcd 11694, 11968 (2005).
[31] *Id.* at 11968.
[32] *Id*. *See also DigitalGlobe, Inc.*, 20 FCC Rcd 15696, 15699 (2005) (waiving Sections 25.156 and 25.157).
[33] 47 C.F.R. § 25.217.
[34] *See* IBFS File Nos. SAT-LOA-20120322-00058

with technical requirements in Part 2 of the Commission's rules and applicable ITU regulations. With respect to SkySat-1 and SkySat-2 the Commission concluded that because the technical requirements specified in Part 2 were sufficient to prevent harmful interference in the 8025-8400 MHz band, there was no need to impose additional technical requirements on operations in that band, and therefore granted the waiver request.[35] Given that the follow-on satellites proposed in the instant modification application do not materially deviate in design from the original SkySat-1 and SkySat-2 spacecraft, the Commission should similarly grant Skybox a waiver of the default service rules contained in Section 25.217(b) for SkySat-3 through SkySat-15.

C. Form 312, Schedule S

As required by the Commission's rules and policies, Skybox has completed, to the best of its ability and the limitations of the Commission's software, the FCC Form 312, Schedule S submission that reflects the orbital and physical/electrical characteristics of the satellites proposed in this Application. Certain data fields in Microsoft Access Database file would not accept Skybox's data, which, in turn, caused errors in the database. To rectify this, Skybox entered generic information into the electronic database file in order to maintain the integrity of the system. In particular, while the SkySat satellites do not employ transponders, the Schedule S software requires entries in exempt fields of table S7[36] and would not allow completion of the form beyond item S10 without an entry in the otherwise inapplicable table.[37] The one line of data provided there is thus a placeholder entry and should be disregarded. Similarly, the performance parameters called for in Columns h and i of item S11 are inapplicable for the Skybox system links. Skybox refers the Commission to the link budgets in Attachment B to this exhibit for full information regarding the performance of SkySat links.

To the best of Skybox's understanding, the information in Form 312, Schedule S is complete. Any additional information used to complete the application process is identified in the instant exhibit. Skybox requests whatever leave of the Commission it may need to resolve the software incompatibility issue in the fashion outlined in the

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[35] *See Id.,* DA No. 12-1520 dated September 21, 2012 (Public Notice approving SkySat-1 and SkySat-2 operations based on compliance with Part 2 and applicable ITU service rules); *see also DigitalGlobe, Inc.*, 20 FCC Rcd 15696, 15701 (2005) (determining that compliance with Part 2 and applicable ITU service rules provides adequate interference protection to other spectrum users from space-to-earth emissions from EESS satellites with X-band (8025-8400 MHz) feeder links).

[36] Section 25.114(c)(4)(v) of the Commission's rules expressly exempts receive command beams (applicable for all Skysat-3 through Skysat-15 earth-to-space beams) from the requirements of providing gain-to-temperature ratio and saturation power flux density information. Therefore in Schedule S the dummy value of -999 is entered for table 7.0 and 7.p merely to satisfy the software's requirements.

[37] In other cases (e.g., items S12 and S13) that do not apply to the SkySat satellites, the items could be left blank without affecting completion of the Schedule S portion of the Form 312.

previous paragraph.

D. Implementation Milestones

As noted above, Skybox has indicated under Section 25.113(f) of the Commission's rules that it has initiated construction of SkySat-3 through SkySat-15. Skybox intends to supply the Commission with information sufficient to demonstrate that it has satisfied the first three implementation milestones under Section 25.164(b) for NGSO systems in a separate submission at a later date. Skybox understands that in the absence of a favorable Commission determination of milestone compliance issued with the grant of this application or within 30 days thereafter, the full amount of the bond specified in Section 25.165(a)(1) will be required.

E. ITU Advance Publication Materials and Cost Recovery

Skybox has prepared the ITU Advance Publication Information submission for its proposed non-geostationary EESS system, and has provided this information to the Commission under separate cover. In particular, Skybox has provided an electronic file with this information to the Satellite Engineering Branch of the Satellite Division of the Commission's International Bureau. Skybox has also provided a letter acknowledging that it is responsible for any and all cost recovery fees associated with filings for the proposed system under ITU Council Decision 482 (modified 2008), as it may be modified or succeeded in the future.

* * *

For the reasons set out above, Skybox respectfully requests the Commission to grant the modification of launch and operation authority as detailed herein. To the extent necessary, Skybox requests expedited consideration of this Application in order to ensure favorable Commission action in advance of the anticipated December 2015 launch of SkySat-3.

ATTACHMENT A

NOTIFICATION OF COMMENCEMENT OF SPACE STATION CONSTRUCTION

Skybox Imaging, Inc. (Skybox), pursuant to Section 25.113(f) of the Commission's rules, 47 C.F.R. § 25.113(f), hereby notifies the Commission that it has commenced construction, at its own risk, of 13 non-geostationary orbit (NGSO) satellites it proposes to launch and operate in the Application to which this statement is attached. Skybox intends to utilize these spacecraft to implement a NGSO Earth Exploration-Satellite Service system.

ATTACHMENT B

LINK BUDGETS

Figures 1 through 4 depict the link budgets for SkySat-3 through SkySat-15 at their intended altitude of 500 km. Figures 5 through 8 depict link budgets for the minimum altitude of 400 km. Figures 9 through 12 depict link budgets for the maximum altitude of 630 km.

Note that the TT&C downlink budgets show two channel bandwidth options. The data rate and corresponding bandwidth is selectable for both channels. One is for the 256 kHz transmission bandwidth case (corresponding to transponders TTC1 & TTC2 in Schedule S Table S9) and the other is for the 512 kHz bandwidth transmission case (corresponding to transponders TTC3 & TTC4 in Schedule S Table S9). The data rate will be selected by mission operations as required for satellite health and safety. The PFD levels represented in Schedule S Table S8 for the TTC Beam present the highest PFD case occurring with the 256 kHz channel bandwidth.

Note that there are two payload data downlink link budgets presented for each altitude. One is for the 60 MHz transmission bandwidth case (corresponding to transponders PLD1, PLD2, & PLD3 in Schedule S Table S9) and the other is for the 100 MHz bandwidth transmission case (corresponding to transponders PLD4, PLD5, & PLD6 in Schedule S Table S9). The SkySat satellites can select between 45 msps (60

MHz) and 76 msps (100 MHz) sample rates and between many modulation modes. A useful modulation rate is shown in each of the budgets and will be selected during mission operations to ensure adequate link margin. Also note that the transmission power for the 100MHz bandwidth case is higher by 2.3 dB over the 60 MHz bandwidth case however PFD levels remain the same in the 4 kHz reference bandwidth as represented in Schedule S Table S8 for the PLD Beam. Schedule S Table S7 present the higher Power and EIRP required for the 100 MHz bandwidth.

Section 25.114(c)(4)(v) of the Commission's Rules requests for command beams, the beam peak flux density at the command threshold. Since Schedule S does not include an entry point for the parameter and it is not expressly specified elsewhere in this exhibit, we specify it here for completeness. The beam peak flux density at the command threshold for the earth-to-space command beam of SkySat-3 through SkySat-15 is -107.9 dBW/m^2 where we define that as the minimum power required to achieve command receiver lock.

TT&C Downlink Analysis	Channel 1	Channel 2	
General			
Orbit Altitude	500	500	km
Ground Elevation Angle	5	5	deg
Slant range	2078	2078	km
Transmission (Space Station)			
Frequency	8.375	8.380	GHz
Symbol rate (2)	128	256	ksps
Channel Bandwidth	256	512	kHz
PA Output Power	0.8	0.8	W
Circuit Loss	3.4	3.4	dB
Antenna Gain (1)	-5	-5	dBi
Antenna HPBW	70	70	deg
EIRP of Spacecraft	-9.4	-9.4	dBW
Reception (Ground Station)			
Free Space Loss	177.2	177.2	dB
Pointing Loss	1	1	dB
Polarization Loss	1.5	1.5	dB
Atmospheric Loss, clear sky	0.8	0.8	dB
Ground antenna gain	43.8	43.8	dBi
Antenna HPBW	1.1	1.1	deg
Received power at LNA input	-116.1	-116.1	dBm
Ground System G/T (at 5 deg)	22	22	dB/K
Received C/No	60.7	60.7	dBHz
Received Es/No	9.6	6.6	dB
Demodulator (Ground Station)			
Modulation	DPSK	DPSK	
Symbol rate	128	256	ksps
Composite code rate	0.50	0.50	
Uncoded data rate (2)	64	128	kbps
Target BER	1E-05	1E-05	
Demodulator Implementation loss	0.5	0.5	dB
Required Es/No at target BER	2.5	2.5	dB
Link Margin	**7.1**	**4.1**	**dB**
(1) Assumes Spacecraft is nadir pointed during AOS			
(2) The symbol rate is selectable, 128 or 256 ksps on either channel			

Figure 1, SkySat TT&C Downlink (X-band) Link Budget for 500 km (nominal) altitude

Command Uplink Analysis		Channel 1	Channel 2	
General				
	Orbit Altitude	500	500	km
	Ground Elevation Angle	5	5	deg
	Slant range	2078	2078	km
Transmission (Ground Station)				
	Frequency	2.081	2.083	GHz
	Symbol rate	32	32	ksps
	Channel Bandwidth	124	124	kHz
	PA Output Power (Watts)	15.8	15.8	W
	PA Output Power (dBW)	12.0	12.0	dBW
	Circuit Loss	1.5	1.5	dB
	Antenna Peak Gain	32	32	dBi
	Antenna HPBW	4.2	4.2	deg
	EIRP of Ground Antenna	42.5	42.5	dBW
Reception (Space Station)				
	Atmospheric Loss, clear sky	0.4	0.4	dB
	Free Space Loss	165.1	165.1	dB
	Pointing Loss	0.5	0.5	dB
	Polarization Loss	1.5	1.5	dB
	Antenna HPBW	70	70	deg
	Antenna Gain (1)	-3	-3	dBi
	Circuit Loss	0.9	0.9	dB
	Received power at LNA input	-98.9	-98.9	dBm
Demodulator (Space Station)				
	Modulation	FSK	FSK	
	Symbol rate	32	32	ksps
	Composite code rate	1.00	1.00	
	Uncoded data rate	32	32	kbps
	Target BER	1E-05	1E-05	
	Required Signal Level at Target BER	-107	-107	dBm
	Received Signal Level	-98.9	-98.9	dBm
	Link Margin	**8.1**	**8.1**	**dB**
	(1) Assumes Spacecraft is nadir pointed during AOS			

Figure 2, SkySat TT&C Uplink (S-band) Link Budget for 500 km (nominal) altitude

Payload Downlink Analysis	Channel 1	Channel 2	Channel 3	
General				
Orbit Altitude	500	500	500	km
Elevation Angle	5	5	5	deg
Slant range	2078	2078	2078	km
Transmission (Space Station)				
Frequency	8.075	8.200	8.325	GHz
Symbol rate	45	45	45	msps
Channel Bandwidth	60	60	60	MHz
PA Output Power	0.8	0.8	0.8	W
Circuit Loss	4.3	4.3	4.3	dB
Antenna Peak Gain	26.7	26.9	27	dBi
Antenna HPBW	5.7	5.7	5.7	deg
EIRP of Spacecraft	21.4	21.6	21.7	dBW
Reception (Ground Station)				
Free Space Loss	176.9	177.0	177.2	dB
Pointing Loss	1	1	1	dB
Polarization Loss	0.3	0.3	0.3	dB
Atmospheric Loss, clear sky	0.8	0.8	0.8	dB
Ground antenna gain	43.5	43.7	43.8	dBi
Antenna HPBW	1.1	1.1	1.1	deg
Received power at LNA input	-84.1	-83.8	-83.7	dBm
Ground System G/T (at 5 deg)	21.7	21.9	22	dB/K
Received C/No	92.7	93.0	93.1	dBHz
Received Es/No	16.2	16.5	16.5	dB
Demodulator (Ground Station)				
Modulation (1)	16APSK	16APSK	16APSK	
Symbol rate	45	45	45	msps
Composite Code rate	0.89	0.89	0.89	
Uncoded data rate	155	155	155	mbps
Target BER	1E-10	1E-10	1E-10	
Demodulator Implementation loss	0.5	0.5	0.5	dB
Required Es/No at target BER	13.4	13.4	13.4	dB
Link Margin	**2.8**	**3.1**	**3.1**	**dB**

(1) The modulation and data rate is selectable on all channels to optimize link margin

Figure 3, SkySat Payload Data Downlink (X-band) 60 MHz Bandwidth Link Budget for 500 km (nominal) altitude

Payload Downlink Analysis	Channel 1	Channel 2	Channel 3	
General				
Orbit Altitude	500	500	500	km
Elevation Angle	5	5	5	deg
Slant range	2078	2078	2078	km
Transmission (Space Station)				
Frequency	8.075	8.200	8.325	GHz
Symbol rate	76	76	76	msps
Channel bandwidth	100	100	100	MHz
PA Output Power	1.35	1.35	1.35	W
Circuit Loss	4.3	4.3	4.3	dB
Antenna Peak Gain	26.7	26.9	27	dBi
Antenna HPBW	5.7	5.7	5.7	deg
EIRP of Spacecraft	23.7	23.9	24.0	dBW
Reception (Ground Station)				
Free Space Loss	176.9	177.0	177.2	dB
Pointing Loss	1	1	1	dB
Polarization Loss	0.3	0.3	0.3	dB
Atmospheric Loss, clear sky	0.8	0.8	0.8	dB
Ground antenna gain	43.5	43.7	43.8	dBi
Antenna HPBW	1.1	1.1	1.1	deg
Received power at LNA input	-81.8	-81.5	-81.5	dBm
Ground System G/T (at 5 deg)	21.7	21.9	22	dB/K
Received C/No	95.0	95.3	95.3	dBHz
Received Es/No	16.2	16.5	16.5	dB
Demodulator (Ground Station)				
Modulation (1)	16APSK	16APSK	16APSK	
Symbol rate	76	76	76	msps
Composite Code rate	0.89	0.89	0.89	
Uncoded data rate	262	262	262	mbps
Target BER	1E-10	1E-10	1E-10	
Demodulator Implementation loss	0.5	0.5	0.5	dB
Required Es/No at target BER	13.4	13.4	13.4	dB
Link Margin	**2.8**	**3.1**	**3.1**	**dB**

(1) The modulation and data rate is selectable on all channels to optimize link margin

Figure 4, SkySat Payload Data Downlink (X-band) 100 MHz Bandwidth Link Budget for 500 km (nominal) altitude

TT&C Downlink Analysis		Channel 1	Channel 2	
General				
	Orbit Altitude	400	400	km
	Ground Elevation Angle	5	5	deg
	Slant range	1805	1805	km
Transmission (Space Station)				
	Frequency	8.375	8.380	GHz
	Symbol rate (2)	128	256	ksps
	Channel Bandwidth	256	512	kHz
	PA Output Power	0.8	0.8	W
	Circuit Loss	3.4	3.4	dB
	Antenna Gain (1)	-5	-5	dBi
	Antenna HPBW	70	70	deg
	EIRP of Spacecraft	-9.4	-9.4	dBW
Reception (Ground Station)				
	Free Space Loss	176.0	176.0	dB
	Pointing Loss	1	1	dB
	Polarization Loss	1.5	1.5	dB
	Atmospheric Loss, clear sky	0.8	0.8	dB
	Ground antenna gain	43.8	43.8	dBi
	Antenna HPBW	1.1	1.1	deg
	Received power at LNA input	-114.9	-114.9	dBm
	Ground System G/T (at 5 deg)	22	22	dB/K
	Received C/No	61.9	61.9	dBHz
	Received Es/No	10.9	7.9	dB
Demodulator (Ground Station)				
	Modulation	DPSK	DPSK	
	Symbol rate	128	256	ksps
	Composite code rate	0.50	0.50	
	Uncoded data rate (2)	64	128	kbps
	Target BER	1E-05	1E-05	
	Demodulator Implementation loss	0.5	0.5	dB
	Required Es/No at target BER	2.5	2.5	dB
	Link Margin	**8.4**	**5.4**	**dB**
	(1) Assumes Spacecraft is nadir pointed during AOS			
	(2) The symbol rate is selectable, 128 or 256 ksps on either channel			

Figure 5, SkySat TT&C Downlink (X-band) Link Budget for 400 km altitude

Command Uplink Analysis	Channel 1	Channel 2	
General			
Orbit Altitude	400	400	km
Ground Elevation Angle	5	5	deg
Slant range	1805	1805	km
Transmission (Ground Station)			
Frequency	2.081	2.083	GHz
Symbol rate	32	32	ksps
Channel Bandwidth	124	124	kHz
PA Output Power (Watts)	15.8	15.8	W
PA Output Power (dBW)	12.0	12.0	dBW
Circuit Loss	1.5	1.5	dB
Antenna Peak Gain	32	32	dBi
Antenna HPBW	4.2	4.2	deg
EIRP of Ground Antenna	42.5	42.5	dBW
Reception (Space Station)			
Atmospheric Loss, clear sky	0.4	0.4	dB
Free Space Loss	163.9	163.9	dB
Pointing Loss	0.5	0.5	dB
Polarization Loss	1.5	1.5	dB
Antenna HPBW	70	70	deg
Antenna Gain (1)	-3	-3	dBi
Circuit Loss	0.9	0.9	dB
Received power at LNA input	-97.7	-97.7	dBm
Demodulator (Space Station)			
Modulation	FSK	FSK	
Symbol rate	32	32	ksps
Composite code rate	1.00	1.00	
Uncoded data rate	32	32	kbps
Target BER	1E-05	1E-05	
Required Signal Level at Target BER	-107	-107	dBm
Received Signal Level	-97.7	-97.7	dBm
Link Margin	**9.3**	**9.3**	**dB**
(1) Assumes Spacecraft is nadir pointed during AOS			

Figure 6, SkySat TT&C Uplink (S-band) Link Budget for 400 km altitude

Payload Downlink Analysis	Channel 1	Channel 2	Channel 3	
General				
Orbit Altitude	400	400	400	km
Elevation Angle	5	5	5	deg
Slant range	1805	1805	1805	km
Transmission (Space Station)				
Frequency	8.075	8.200	8.325	GHz
Symbol rate	45	45	45	msps
Channel Bandwidth	60	60	60	MHz
PA Output Power	0.8	0.8	0.8	W
Circuit Loss	4.3	4.3	4.3	dB
Antenna Peak Gain	26.7	26.9	27	dBi
Antenna HPBW	5.7	5.7	5.7	deg
EIRP of Spacecraft	21.4	21.6	21.7	dBW
Reception (Ground Station)				
Free Space Loss	175.7	175.8	175.9	dB
Pointing Loss	1	1	1	dB
Polarization Loss	0.3	0.3	0.3	dB
Atmospheric Loss, clear sky	0.8	0.8	0.8	dB
Ground antenna gain	43.5	43.7	43.8	dBi
Antenna HPBW	1.1	1.1	1.1	deg
Received power at LNA input	-82.8	-82.6	-82.5	dBm
Ground System G/T (at 5 deg)	21.7	21.9	22	dB/K
Received C/No	94.0	94.2	94.3	dBHz
Received Es/No	17.4	17.7	17.8	dB
Demodulator (Ground Station)				
Modulation (1)	16APSK	16APSK	16APSK	
Symbol rate	45	45	45	msps
Composite Code rate	0.89	0.89	0.89	
Uncoded data rate	155	155	155	mbps
Target BER	1E-10	1E-10	1E-10	
Demodulator Implementation loss	0.5	0.5	0.5	dB
Required Es/No at target BER	13.4	13.4	13.4	dB
Link Margin	**4.0**	**4.3**	**4.4**	**dB**
(1) The modulation and data rate is selectable on all channels				

Figure 7, SkySat Payload Data Downlink (X-band) 60 MHz Bandwidth Link Budget for 400 km altitude

Payload Downlink Analysis	Channel 1	Channel 2	Channel 3	
General				
Orbit Altitude	400	400	400	km
Elevation Angle	5	5	5	deg
Slant range	1805	1805	1805	km
Transmission (Space Station)				
Frequency	8.075	8.200	8.325	GHz
Symbol rate	76	76	76	msps
Channel bandwidth	100	100	100	MHz
PA Output Power	1.35	1.35	1.35	W
Circuit Loss	4.3	4.3	4.3	dB
Antenna Peak Gain	26.7	26.9	27	dBi
Antenna HPBW	5.7	5.7	5.7	deg
EIRP of Spacecraft	23.7	23.9	24.0	dBW
Reception (Ground Station)				
Free Space Loss	175.7	175.8	175.9	dB
Pointing Loss	1	1	1	dB
Polarization Loss	0.3	0.3	0.3	dB
Atmospheric Loss, clear sky	0.8	0.8	0.8	dB
Ground antenna gain	43.5	43.7	43.8	dBi
Antenna HPBW	1.1	1.1	1.1	deg
Received power at LNA input	-80.6	-80.3	-80.2	dBm
Ground System G/T (at 5 deg)	21.7	21.9	22	dB/K
Received C/N_0	96.2	96.5	96.6	dBHz
Received E_s/N_0	17.4	17.7	17.8	dB
Demodulator (Ground Station)				
Modulation (1)	16APSK	16APSK	16APSK	
Symbol rate	76	76	76	msps
Composite Code rate	0.89	0.89	0.89	
Uncoded data rate	262	262	262	mbps
Target BER	1E-10	1E-10	1E-10	
Demodulator Implementation loss	0.5	0.5	0.5	dB
Required E_s/N_0 at target BER	13.4	13.4	13.4	dB
Link Margin	**4.0**	**4.3**	**4.4**	**dB**

(1) The modulation and data rate is selectable on all channels to optimize link margin

Figure 8, SkySat Payload Data Downlink (X-band) 100 MHz Bandwidth Link Budget for 400 km altitude

TT&C Downlink Analysis	Channel 1	Channel 2	
General			
Orbit Altitude	630	630	km
Ground Elevation Angle	5	5	deg
Slant range	2401	2401	km
Transmission (Space Station)			
Frequency	8.375	8.380	GHz
Symbol rate (2)	128	256	ksps
Channel Bandwidth	256	512	kHz
PA Output Power	0.8	0.8	W
Circuit Loss	3.4	3.4	dB
Antenna Gain (1)	-5	-5	dBi
Antenna HPBW	70	70	deg
EIRP of Spacecraft	-9.4	-9.4	dBW
Reception (Ground Station)			
Free Space Loss	178.5	178.5	dB
Pointing Loss	1	1	dB
Polarization Loss	1.5	1.5	dB
Atmospheric Loss, clear sky	0.8	0.8	dB
Ground antenna gain	43.8	43.8	dBi
Antenna HPBW	1.1	1.1	deg
Received power at LNA input	-117.3	-117.3	dBm
Ground System G/T (at 5 deg)	22	22	dB/K
Received C/No	59.5	59.5	dBHz
Received Es/No	8.4	5.4	dB
Demodulator (Ground Station)			
Modulation	DPSK	DPSK	
Symbol rate	128	256	ksps
Composite code rate	0.50	0.50	
Uncoded data rate (2)	64	128	kbps
Target BER	1E-05	1E-05	
Demodulator Implementation loss	0.5	0.5	dB
Required Es/No at target BER	2.5	2.5	dB
Link Margin	**5.9**	**2.9**	**dB**

(1) Assumes Spacecraft is nadir pointed during AOS

(2) The symbol rate is selectable, 128 or 256 ksps on either channel

Figure 9, SkySat TT&C Downlink (X-band) Link Budget for 630 km altitude

Command Uplink Analysis	Channel 1	Channel 2	
General			
Orbit Altitude	630	630	km
Ground Elevation Angle	5	5	deg
Slant range	2401	2401	km
Transmission (Ground Station)			
Frequency	2.081	2.083	GHz
Symbol rate	32	32	ksps
Channel Bandwidth	124	124	kHz
PA Output Power (Watts)	15.8	15.8	W
PA Output Power (dBW)	12.0	12.0	dBW
Circuit Loss	1.5	1.5	dB
Antenna Peak Gain	32	32	dBi
Antenna HPBW	4.2	4.2	deg
EIRP of Ground Antenna	42.5	42.5	dBW
Reception (Space Station)			
Atmospheric Loss, clear sky	0.4	0.4	dB
Free Space Loss	166.4	166.4	dB
Pointing Loss	0.5	0.5	dB
Polarization Loss	1.5	1.5	dB
Antenna HPBW	70	70	deg
Antenna Gain (1)	-3	-3	dBi
Circuit Loss	0.9	0.9	dB
Received power at LNA input	-100.2	-100.2	dBm
Demodulator (Space Station)			
Modulation	FSK	FSK	
Symbol rate	32	32	ksps
Composite code rate	1.00	1.00	
Uncoded data rate	32	32	kbps
Target BER	1E-05	1E-05	
Required Signal Level at Target BER	-107	-107	dBm
Received Signal Level	-100.2	-100.2	dBm
Link Margin	**6.8**	**6.8**	**dB**

(1) Assumes Spacecraft is nadir pointed during AOS

Figure 10, SkySat TT&C Uplink (S-band) Link Budget for 630 km altitude

Payload Downlink Analysis	Channel 1	Channel 2	Channel 3	
General				
Orbit Altitude	630	630	630	km
Elevation Angle	5	5	5	deg
Slant range	2401	2401	2401	km
Transmission (Space Station)				
Frequency	8.075	8.200	8.325	GHz
Symbol rate	45	45	45	msps
Channel Bandwidth	60	60	60	MHz
PA Output Power	0.8	0.8	0.8	W
Circuit Loss	4.3	4.3	4.3	dB
Antenna Peak Gain	26.7	26.9	27	dBi
Antenna HPBW	5.7	5.7	5.7	deg
EIRP of Spacecraft	21.4	21.6	21.7	dBW
Reception (Ground Station)				
Free Space Loss	178.2	178.3	178.4	dB
Pointing Loss	1	1	1	dB
Polarization Loss	0.3	0.3	0.3	dB
Atmospheric Loss, clear sky	0.8	0.8	0.8	dB
Ground antenna gain	43.5	43.7	43.8	dBi
Antenna HPBW	1.1	1.1	1.1	deg
Received power at LNA input	-85.3	-85.1	-85.0	dBm
Ground System G/T (at 5 deg)	21.7	21.9	22	dB/K
Received C/No	91.5	91.7	91.8	dBHz
Received Es/No	14.9	15.2	15.3	dB
Demodulator (Ground Station)				
Modulation (1)	16APSK	16APSK	16APSK	
Symbol rate	45	45	45	msps
Composite Code rate	0.75	0.75	0.75	
Uncoded data rate	130	130	130	mbps
Target BER	1E-10	1E-10	1E-10	
Demodulator Implementation loss	0.5	0.5	0.5	dB
Required Es/No at target BER	10.7	10.7	10.7	dB
Link Margin	**4.2**	**4.5**	**4.6**	**dB**

(1) The modulation and data rate is selectable on all channels to optimize link margin

Figure 11, SkySat Payload Data Downlink (X-band) 60 MHz Link Budget for 630 km altitude

Payload Downlink Analysis	Channel 1	Channel 2	Channel 3	
General				
Orbit Altitude	630	630	630	km
Elevation Angle	5	5	5	deg
Slant range	2401	2401	2401	km
Transmission (Space Station)				
Frequency	8.075	8.200	8.325	GHz
Symbol rate	76	76	76	msps
Channel BW	100	100	100	MHz
PA Output Power	1.35	1.35	1.35	W
Circuit Loss	4.3	4.3	4.3	dB
Antenna Peak Gain	26.7	26.9	27	dBi
Antenna HPBW	5.7	5.7	5.7	deg
EIRP of Spacecraft	23.7	23.9	24.0	dBW
Reception (Ground Station)				
Free Space Loss	178.2	178.3	178.4	dB
Pointing Loss	1	1	1	dB
Polarization Loss	0.3	0.3	0.3	dB
Atmospheric Loss, clear sky	0.8	0.8	0.8	dB
Ground antenna gain	43.5	43.7	43.8	dBi
Antenna HPBW	1.1	1.1	1.1	deg
Received power at LNA input	-83.0	-82.8	-82.7	dBm
Ground System G/T (at 5 deg)	21.7	21.9	22	dB/K
Received C/No	93.8	94.0	94.1	dBHz
Received Es/No	14.9	15.2	15.3	dB
Demodulator (Ground Station)				
Modulation (1)	16APSK	16APSK	16APSK	
Symbol rate	76	76	76	msps
Composite Code rate	0.75	0.75	0.75	
Uncoded data rate	220	220	220	mbps
Target BER	1E-10	1E-10	1E-10	
Demodulator Implementation loss	0.5	0.5	0.5	dB
Required Es/No at target BER	10.7	10.7	10.7	dB
Link Margin	**4.2**	**4.5**	**4.6**	**dB**

(1) The modulation and data rate is selectable on all channels to optimize link margin

Figure 12, SkySat Payload Data Downlink (X-band) 100 MHz Link Budget for 630 km altitude

ATTACHMENT C

SKYSAT SYSTEM ANTENNA PATTERNS

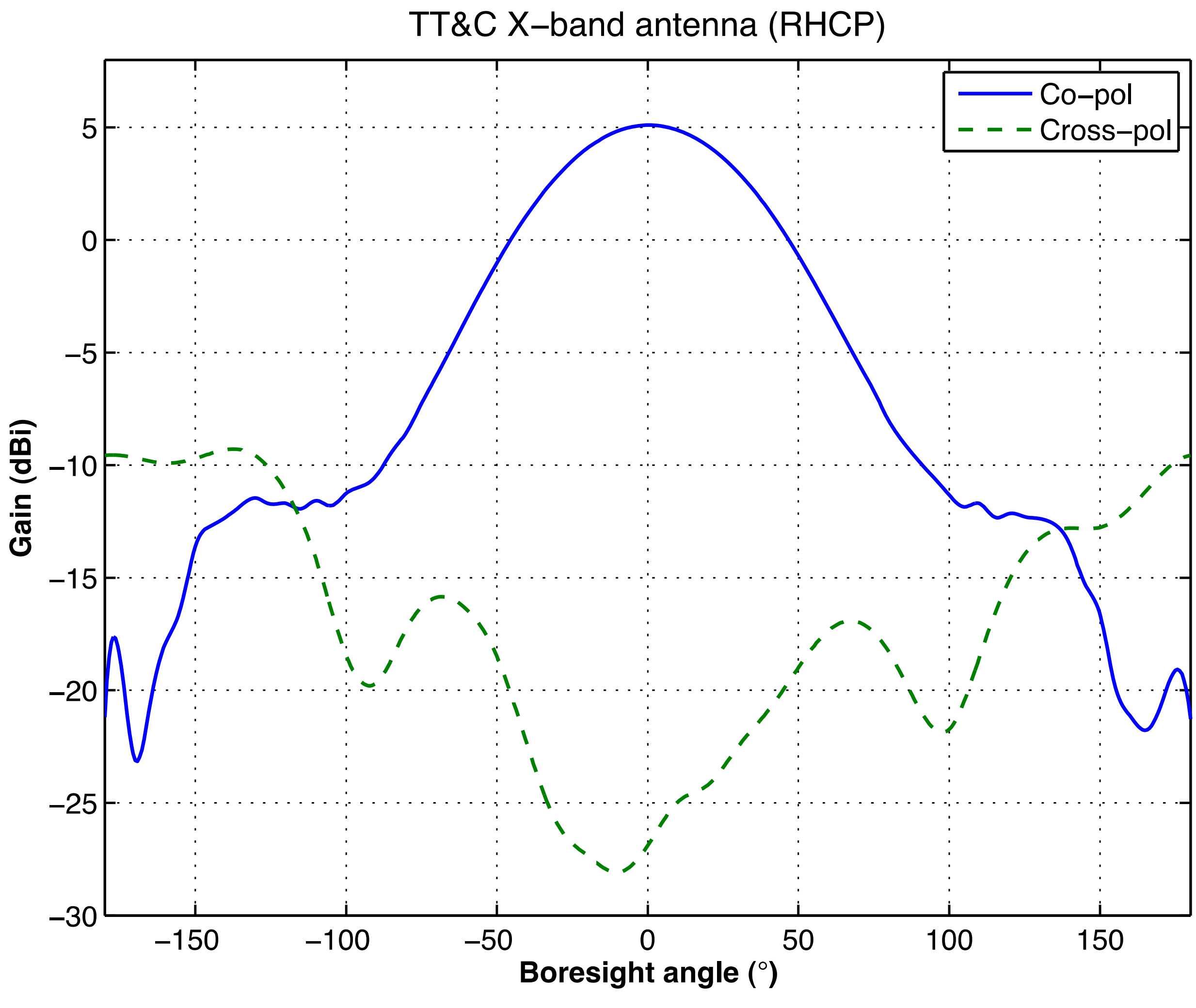


Figure 1, SkySat TT&C Downlink (X-band) Antenna Pattern

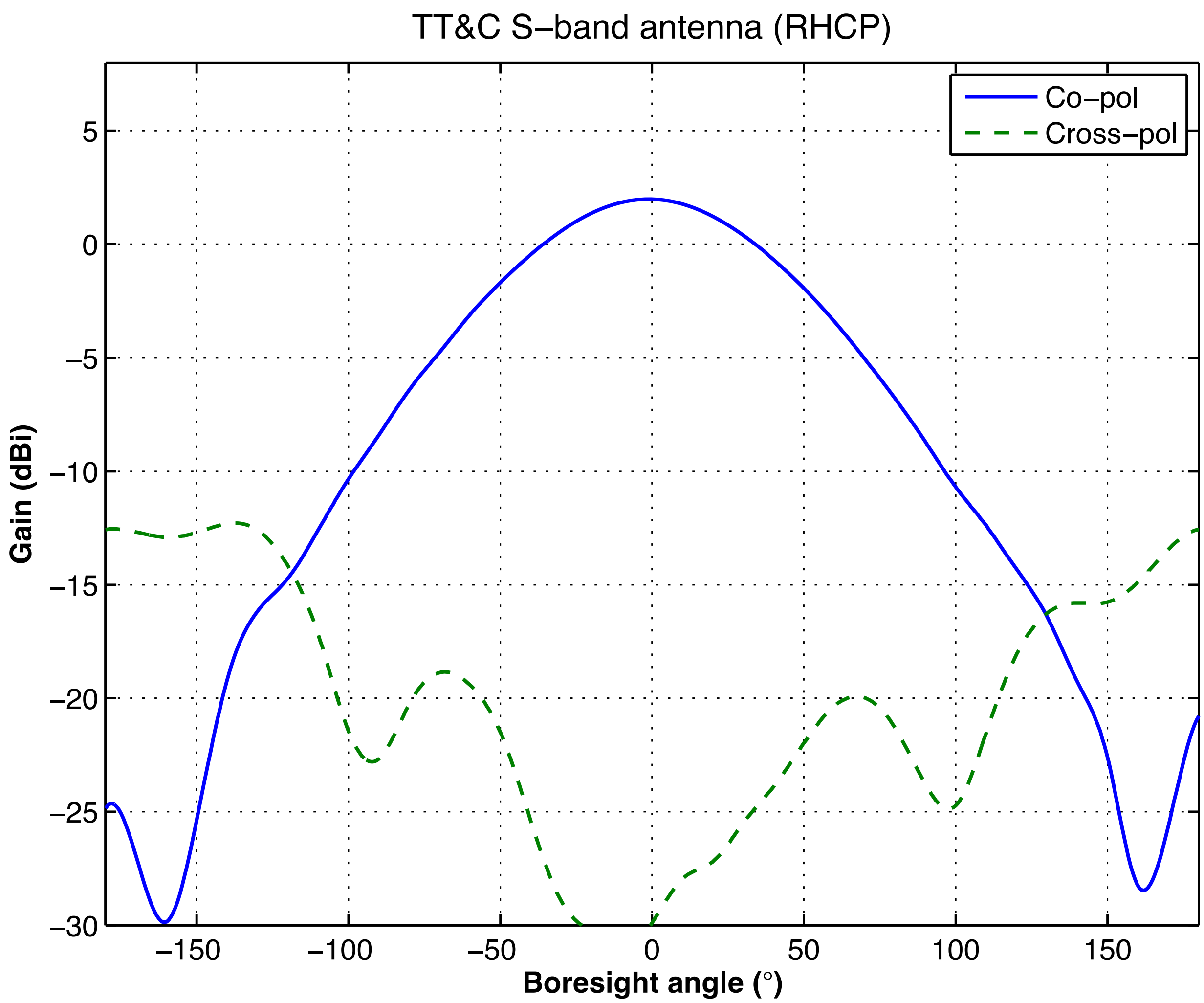


Figure 2, SkySat TT&C Uplink (S-band) Antenna Pattern

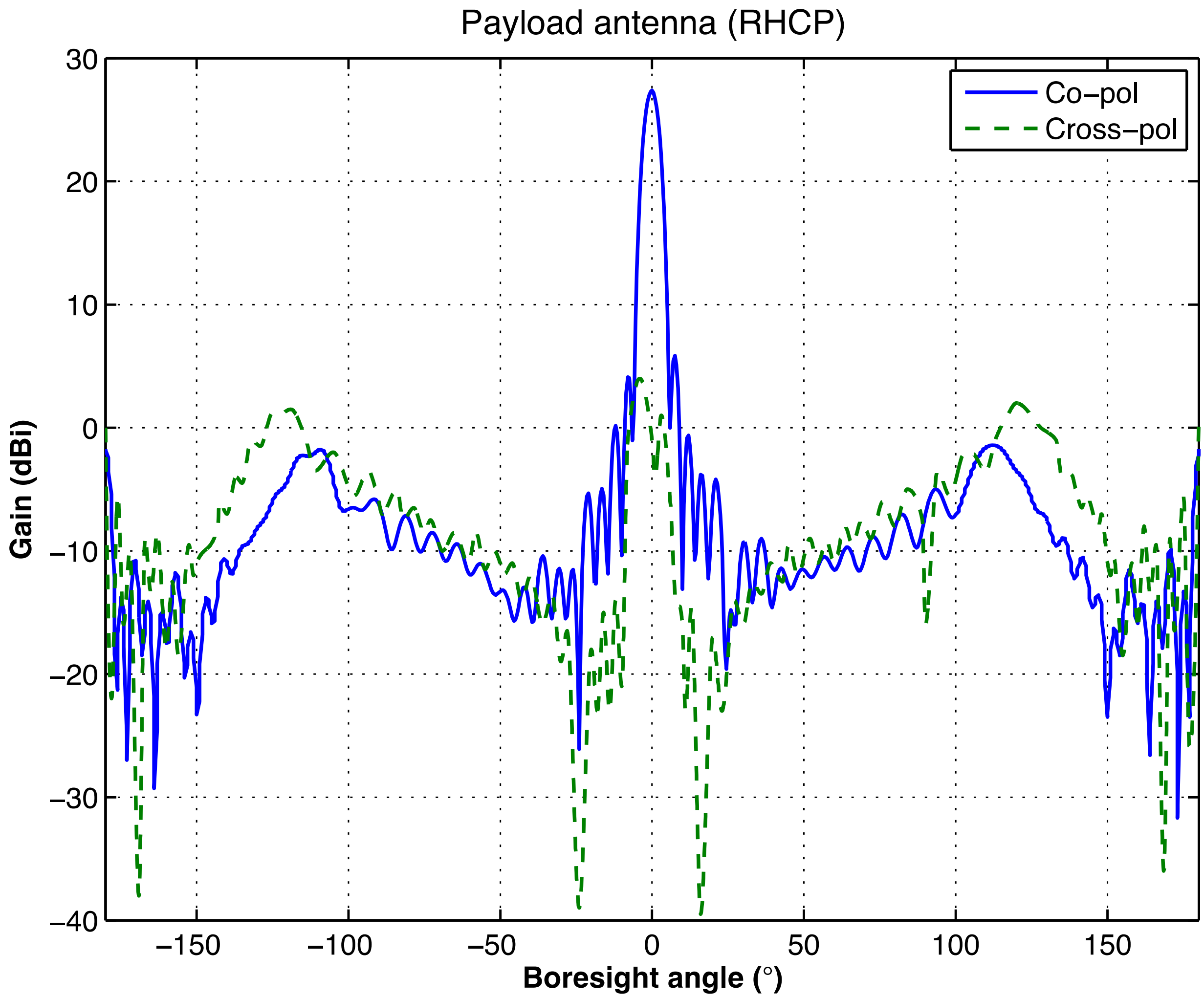


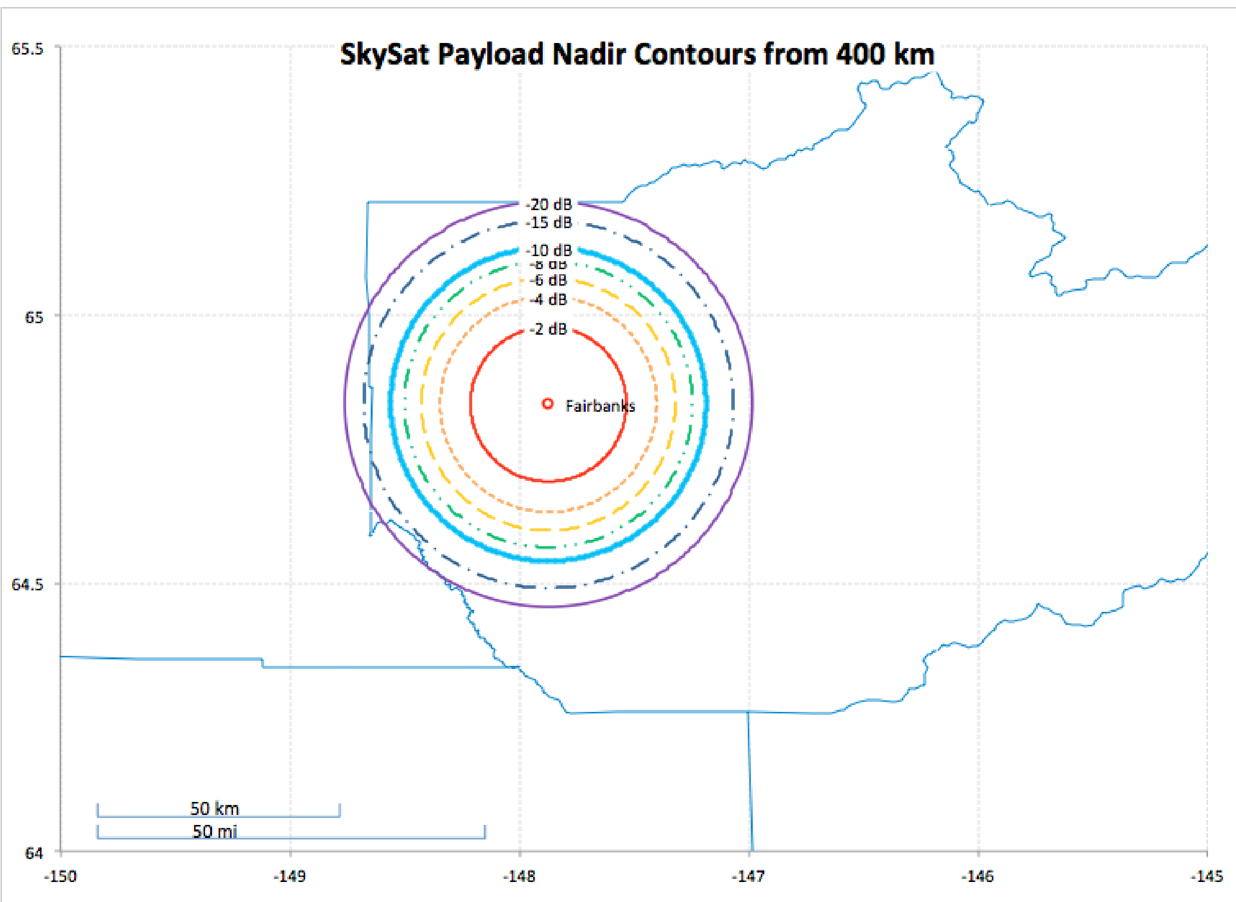
Figure 3, SkySat Data Downlink (X-band) Antenna Pattern

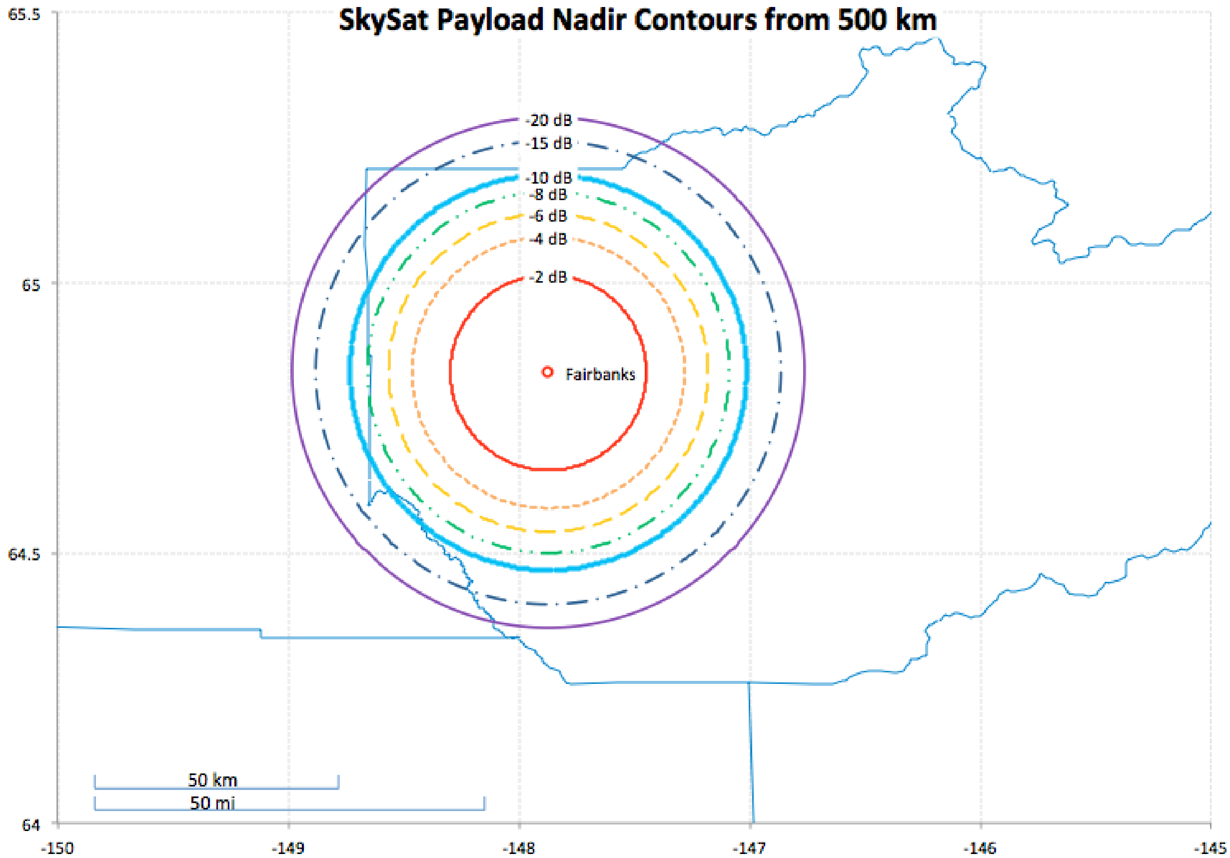
<u>ATTACHMENT D</u>

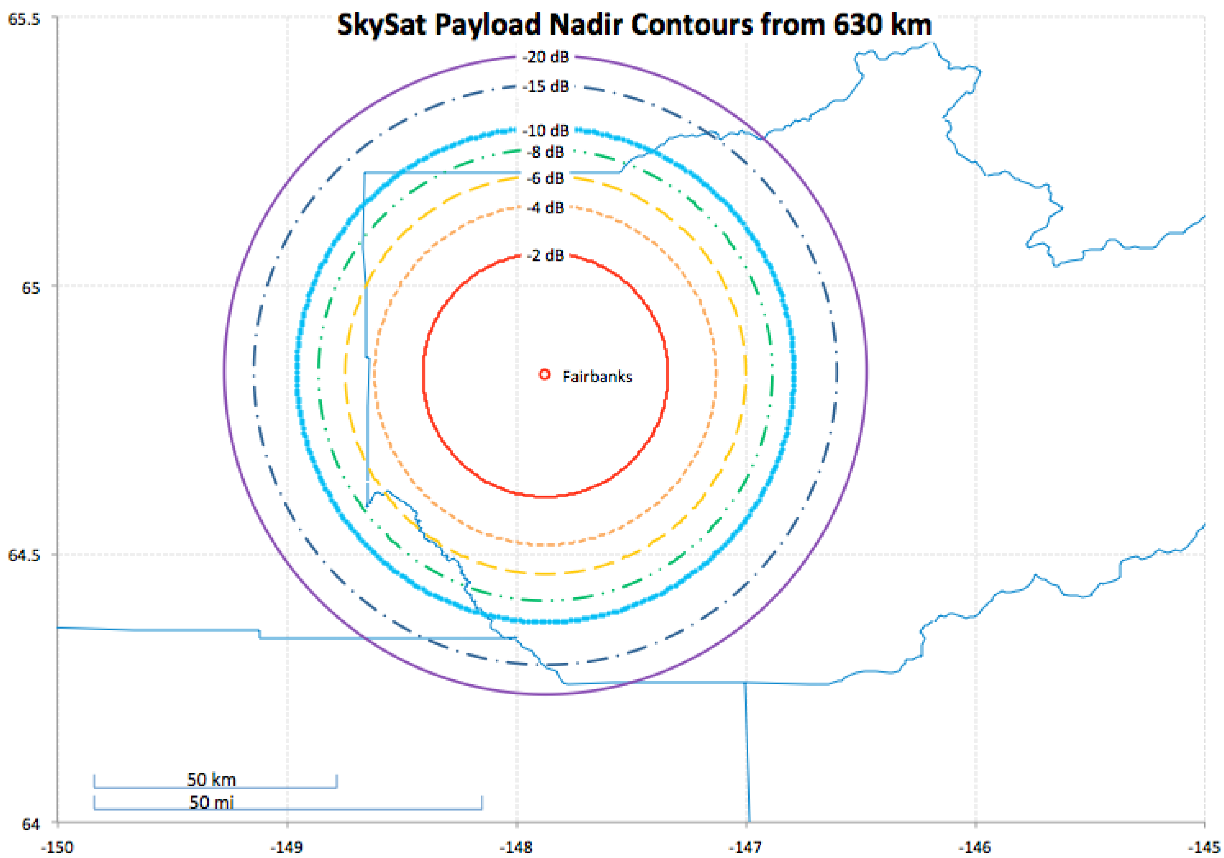
PREDICTED GAIN CONTOURS

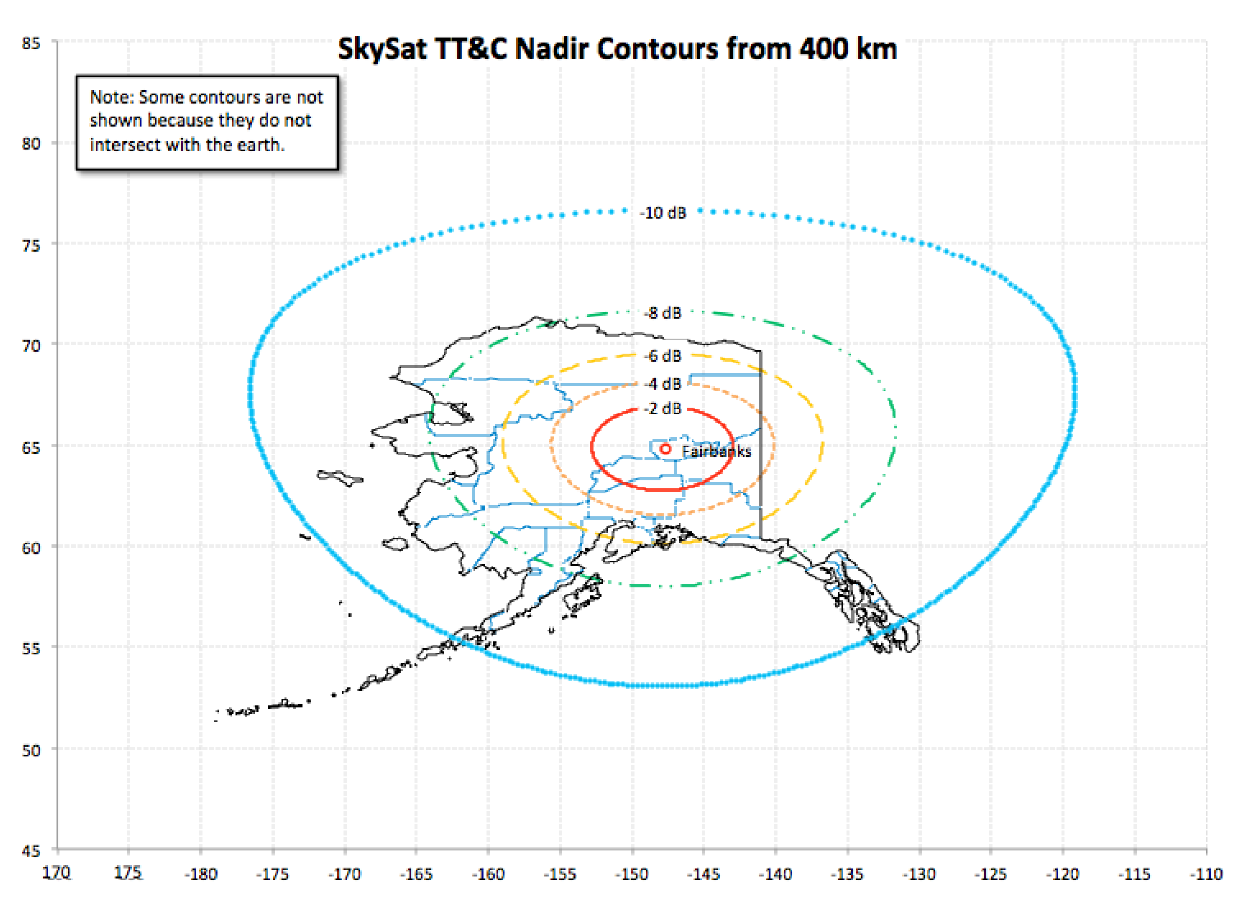
The next 12 Figures depict the antenna gain contours over the Fairbanks Alaska and Half Moon Bay California Earth Stations for both the SkySat payload data downlink and TT&C downlinks for altitudes 400 km (minimum), 500km (nominal), and 630 km (maximum).

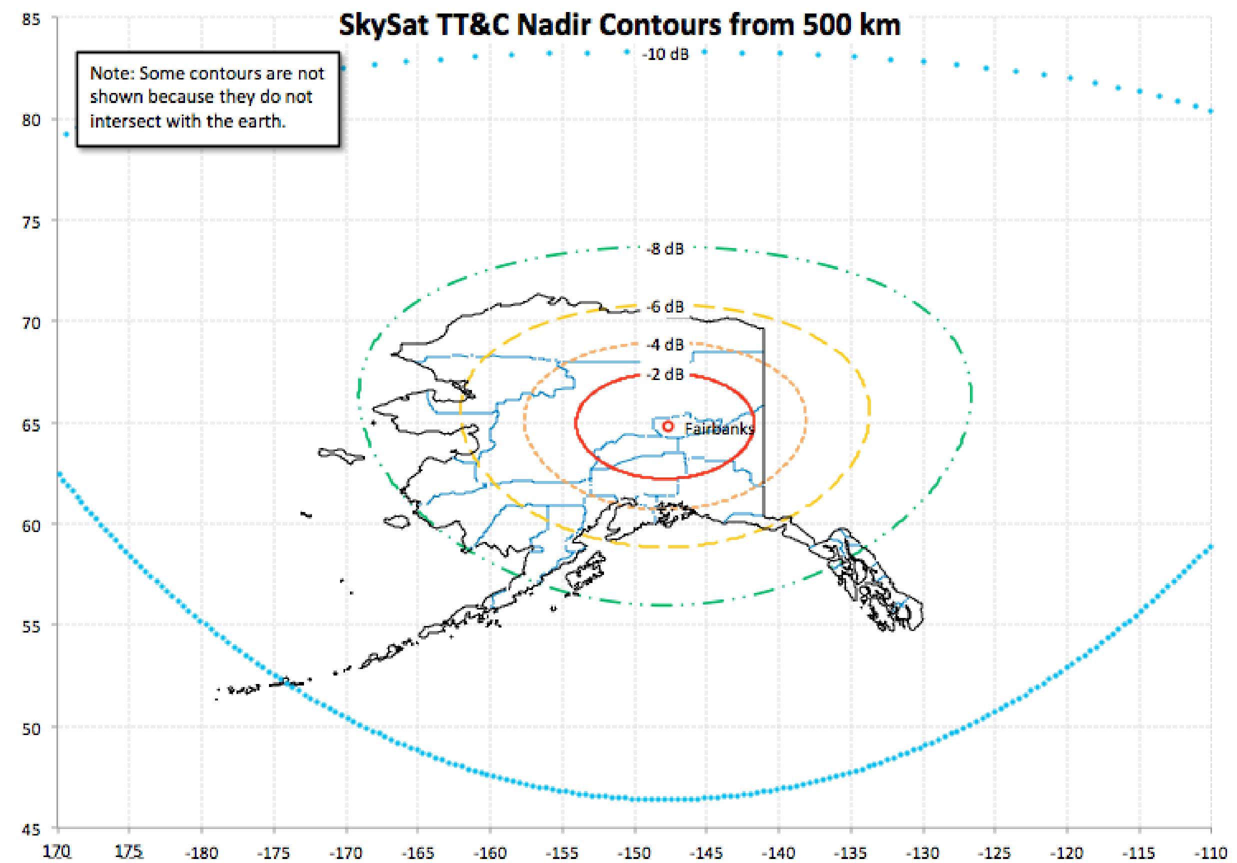
Contours for Fairbanks, Alaska Earth Station

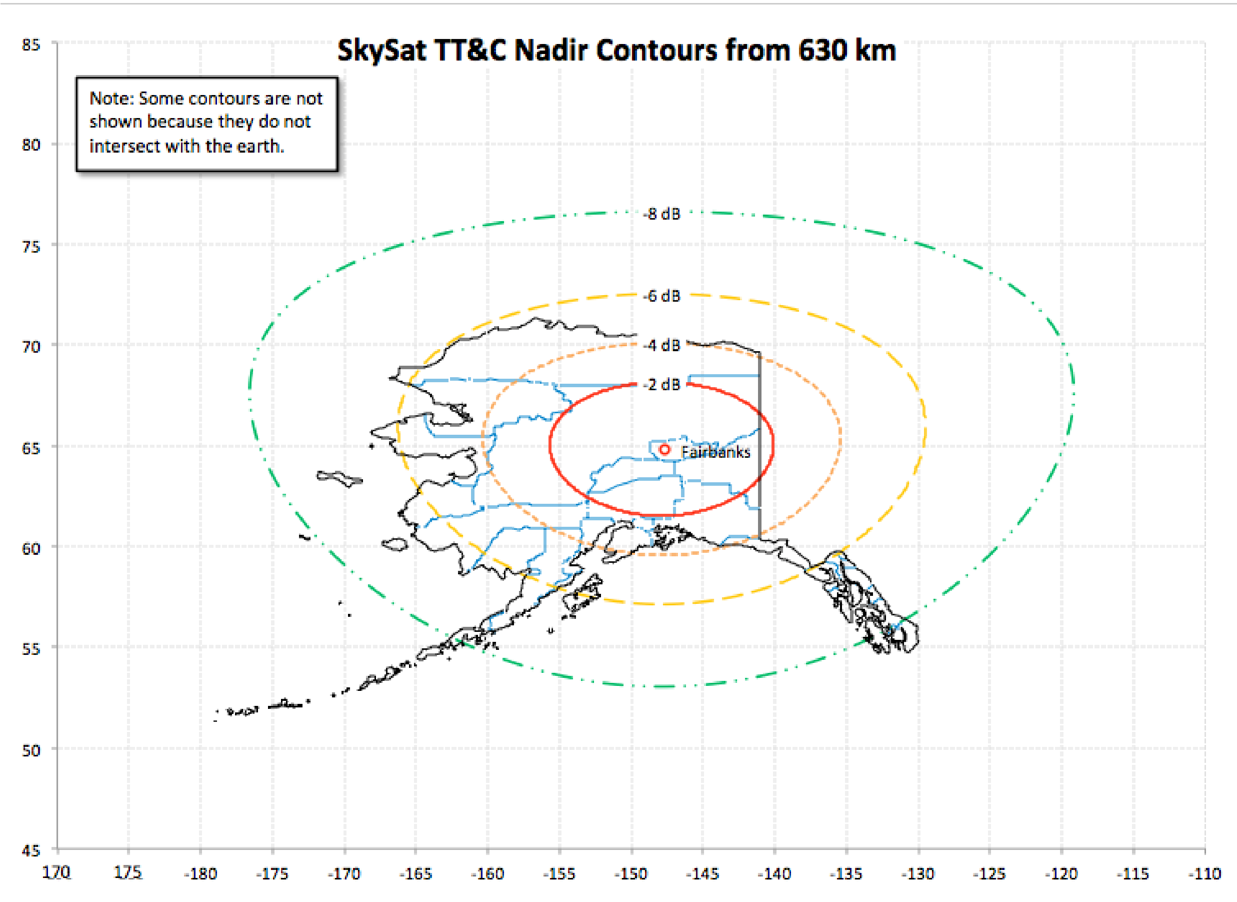



SkySat Payload Nadir Contours from 500 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
50 km
50 mi
65.5
65
64.5
64
-150
-149
-148
-147
-146
-145


SkySat Payload Nadir Contours from 630 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
50 km
50 mi
65.5
65
64.5
64
-150
-149
-148
-147
-146
-145


SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
85
80
75
70
65
60
55
50
45
170
175
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110


SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
85
80
75
70
65
60
55
50
45
170
175
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110


SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
85
80
75
70
65
60
55
50
45
170
175
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110

Contours for Half Moon Bay, California Earth Station

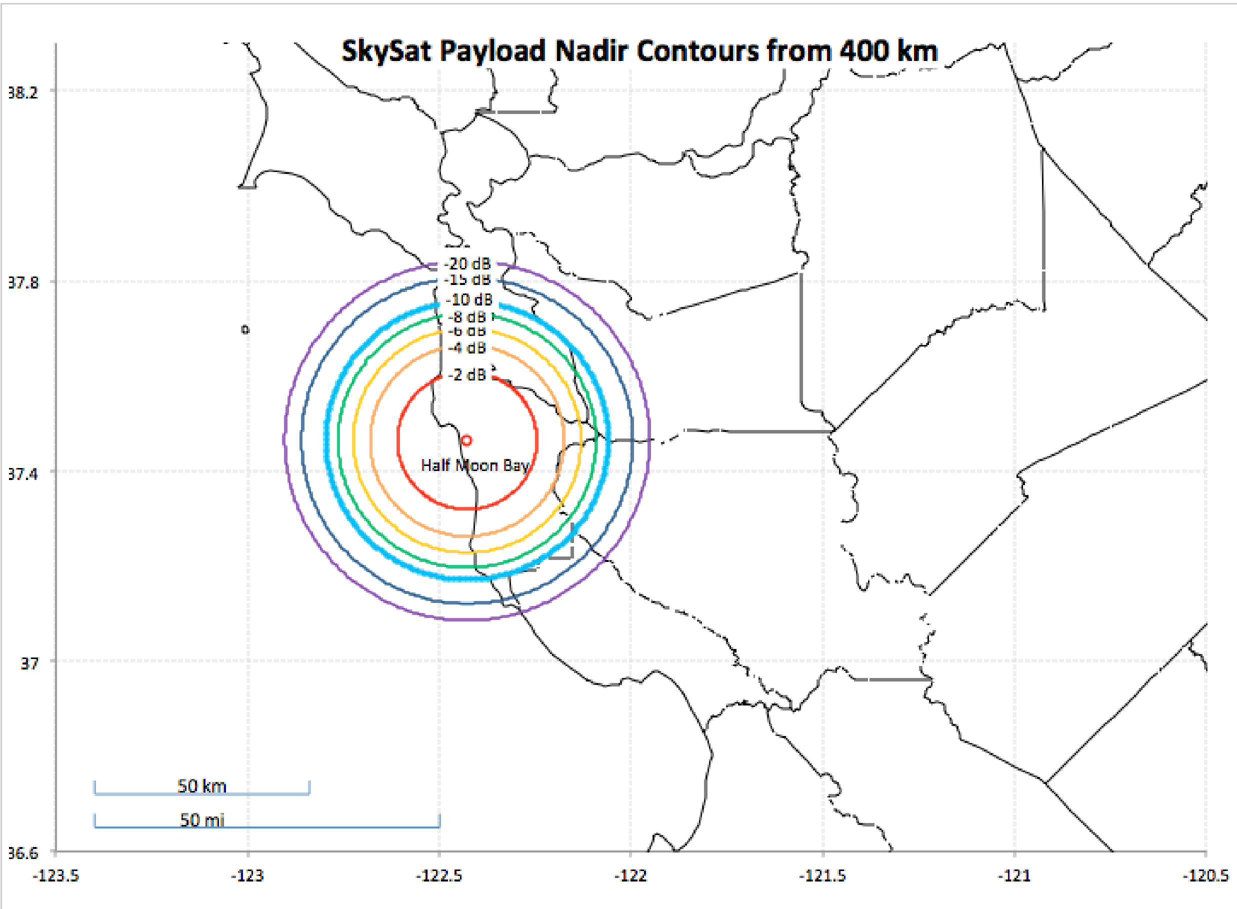


EXHIBIT 43

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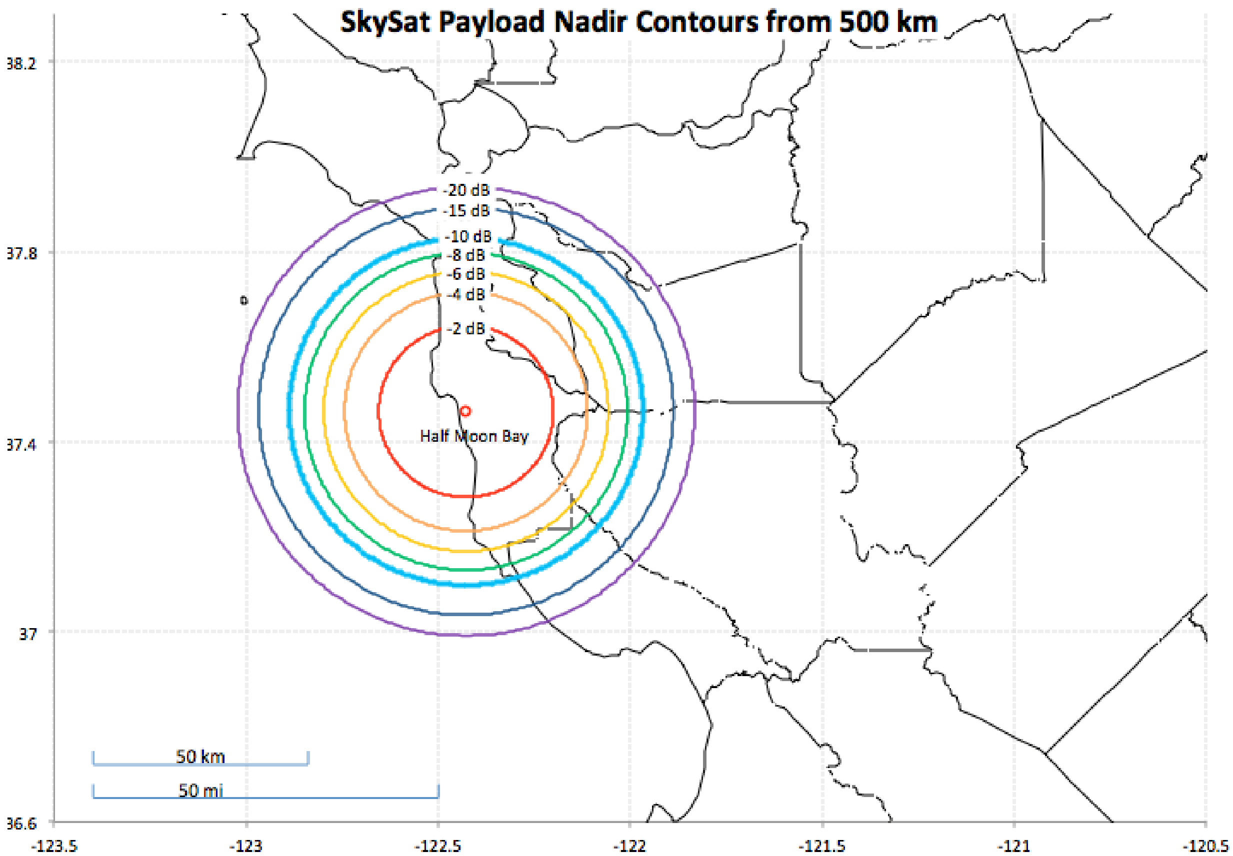
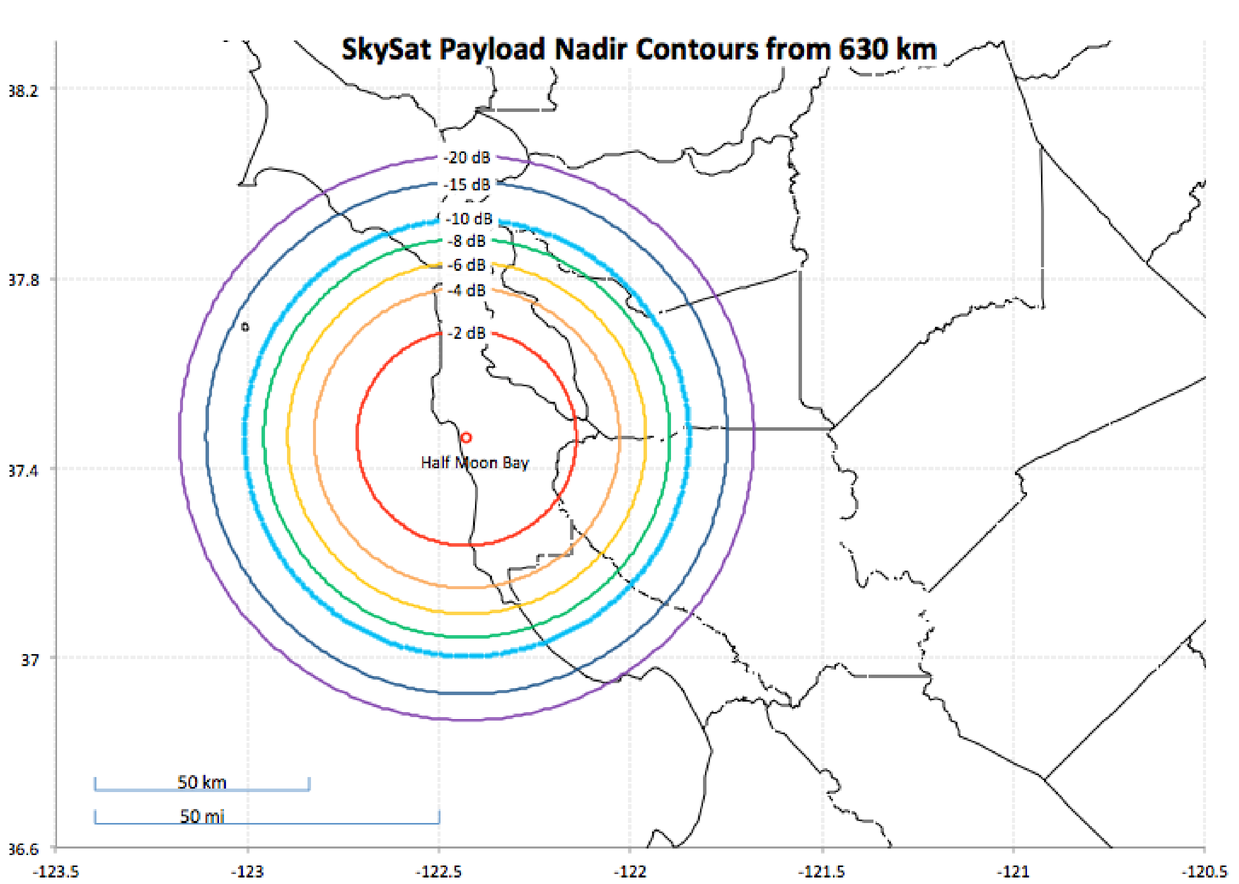
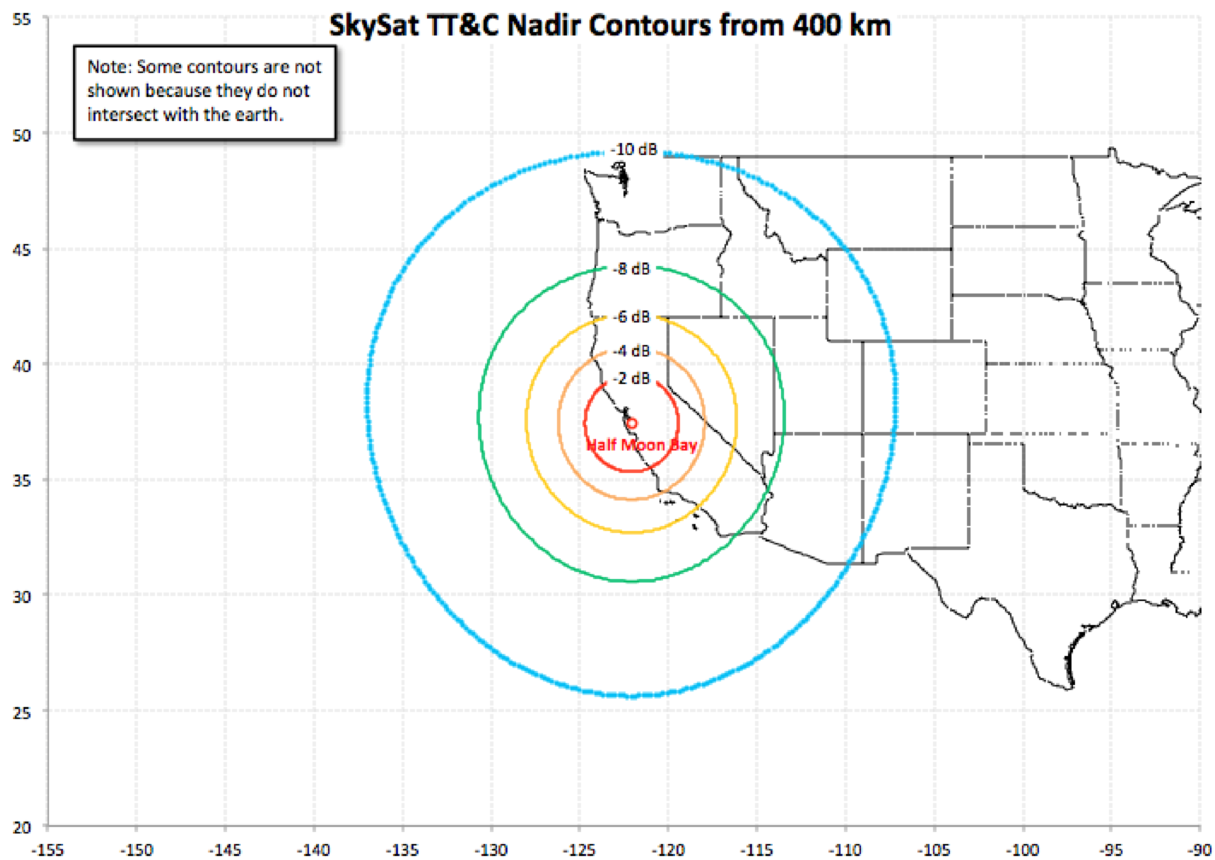
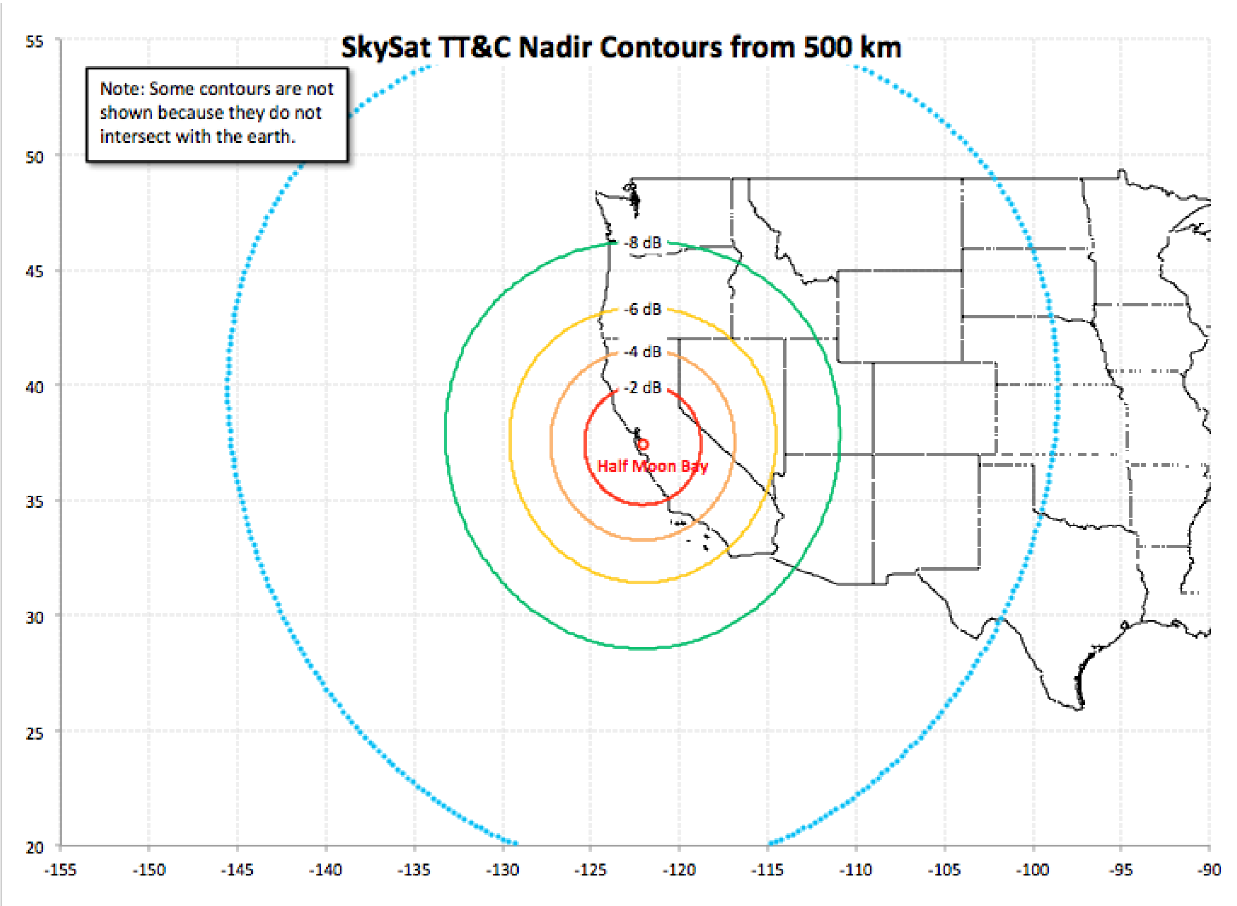



SkySat Payload Nadir Contours from 630 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
50 km
50 mi
38.2
37.8
37.4
37
36.6
-123.5
-123
-122.5
-122
-121.5
-121
-120.5


SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
55
50
45
40
35
30
25
20
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90


SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
55
50
45
40
35
30
25
20
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90

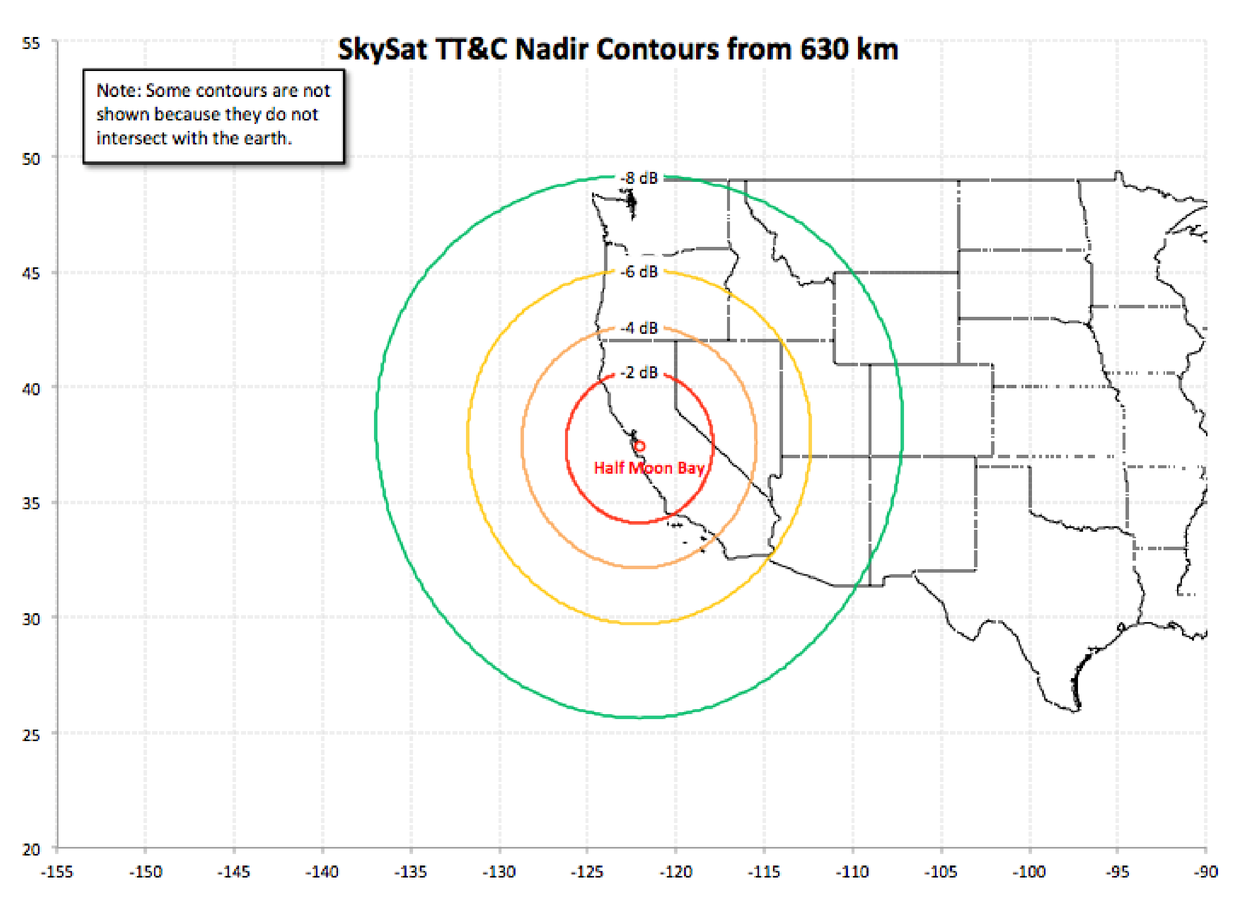

SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
55
50
45
40
35
30
25
20
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90

EXHIBIT 43

Skybox Imaging, Inc.
Application for License Modification

TECHNICAL CERTIFICATE

I, Joe Rothenberg, hereby certify, under penalty of perjury, that I am the technically qualified person responsible for the preparation of the engineering information contained in the technical portions of the foregoing application and the related attachments, that I am familiar with Part 25 of the Commission's rules, and that the technical information is complete and accurate to the best of my knowledge and belief.

Joseph H. Rothenberg
Engineering Director
Skybox Imaging, Inc.

EXHIBIT 43

Skybox Imaging, Inc.
Application for License Modification

<u>CERTIFICATE OF COMPLIANCE</u>

POST-MISSION DISPOSAL PLAN REQUIREMENTS

Pursuant to 47 C.F.R. § 25.114(d)(14)(iv), "[a]pplicants for space stations to be used only for commercial remote sensing may, in lieu of submitting detailed post-mission disposal plans to the Commission, certify that they have submitted such plans to the National Oceanic and Atmospheric Administration for review."[38] I, Joseph H. Rothenberg, of Skybox Imaging, Inc. ("Skybox"), certify under penalty of perjury, that post-mission disposal plans have been submitted and approved by the National Oceanic and Atmospheric Administration, as required by The Remote Sensing Act and NOAA's corresponding rules.[39]

Joseph H. Rothenberg
Engineering Director
Skybox Imaging, Inc.

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[38] 47 C.F.R. § 25.114(d)(14)(iv). *See also Mitigation of Orbital Debris*, IBM Docket No. 02-54, Second Report and Order, 19 FCC Rcd 11567, 11610 at ¶ 104 (2004).

[39] *See* 15 U.S.C. § 5622(b)(4); 15 C.F.R. § 960.11(b)(12). Skybox Imaging Constellation, Commercial Remote Sensing License Amendment Application submitted March 1, 2013; Constellation License granted by NOAA and effective November 20, 2013.